ELECTRICAL REVIEW

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The State of Penn. vs. the Western Union Telegraph Company.

In the Dauphin County Court at Harrisburgh, April 4th, in the suit of the Commonwealth to compel the forfeiture of the Western Union Telegraph Company's charter for alleged consolidation with the Baltimore and Ohio Telegraph Company, counsel for the Western Union presented the pleas and petition for removal of the suit to the United States Circuit Court at Philadelphia. Similar pleas and petitions were presented by counsel for the Baltimore and Ohio Company. Attorney General Kirkpatrick opposed the removal. Hearing of argument was fixed for April 17th.

The Western Union in its plea denies that it or the Baltimore and Ohio are subject to the Constitution and laws of Pennsylvania. It admits that it has acquired substantially the whole stock of the Baltimore and Ohio Telegraph Company, but asserts that it has not consolidated with the said company. It also denies that the Baltimore and Ohio Company owned a competing line of telegraph. It further denies that it holds any part of the capital stock of the Baltimore and Ohio Telegraph Company, of Pennsylvania, or that it at any time consolidated with said company. It further says that the Western Union Telegraph Company is incorporated for telegraph purposes under the laws of New York, with power to construct and operate lines by telegraph, and to sell its own property or to acquire that of others.

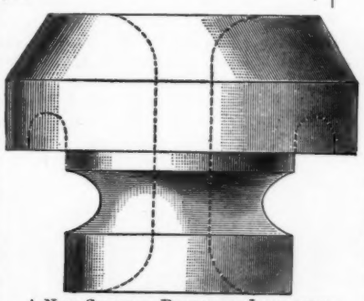
Porcelain Insulators and Supplies.

The widely known Empire China Works, of 144 to 156 Green street, Greenpoint, Brooklyn, N. Y., have for a long time been in the front rank of porcelain manufacturers and have been particularly successful in supplying the needs of the electrical trade in this direction. Their porcelain is extensively used by a large number of the electrical people, and the quality of their goods is not excelled by any manufacturer. The almost innumerable uses to which this excellent non-conductor can be put has created a demand that has crowded the Greenpoint factory of the Empire Works, and a great many new designs have been gotten up by them. We illustrate in this issue of the REVIEW a new insulator called the umbrella insulator. The name is a very appropriate one, for as indicated by the lines in the drawing, a good sized groove extends clear round the inner rim of the insulator, and is of particular advantage in preventing the water during a rain from coming in contact with the wire which passes round the usual groove, compelling the water to drip down outside of the wire. Wherever this insulator has been tried by electric light companies it has given the best of satisfaction, and is now being extensively used in New York city.

The ware manufactured by the Empire China Works is undoubtedly of the best and purest quality, and it is because of this fact that the great non-conductive quality of the company's porcelain is secured. Some three dozen or more special designs particularly fitted for electrical work, such as a large variety of insulators, cleats, bushings, ceiling blocks, battery rings, etc., etc., are kept in stock and manufactured by this company, which has, with prompt enterprise, realized the great opening for this class of work the progress in electrical industry has brought about.

The Magnetic Ore Separator.

It is reported that experiments are soon to be made with one of Edison's most recent inventions, the object of which is to concentrate the real ore dug from a mine and get rid, by mechanical means, of all dirt and earthy matter that interferes with smelting. This machine it is claimed will reduce immensely the cost of smelting and bring into use ores that cannot now be profitably worked. New York capitalists have purchased eight acres of iron ore land, where the experiments will be made. They have been incorporated under the name of the Pennsylvania Concentrating Company. Buildings and machinery are now being put up at a cost of $35,000. The rock containing the ore, after passing through the crusher and broken to the size of an egg, is dumped into a large hopper. From here it drops down an incline within a few inches of a powerful magnet, as recently exclusively illustrated in the REVIEW. This will be so heavily charged as to draw the ore from its course into one channel, and the rock and other foreign elements contained in the ore are permitted to pass through another channel to the refuse pile.



A NEW STYLE OF PORCELAIN INSULATOR.

Electric Lighting at Middletown, N. Y.

A large trade in electric lighting has recently been consummated at Middletown, New York, through the efforts of Mr. W. J. Morrison, general agent of the Fort Wayne Jenney Electric Light Company. The Middletown Electric Light and Power Company has been organized with a capital of $100,000, and has contracted with Mr. Morrison for 2,000 incandescent lights of the Slattery induction system and 150 arc lights of 1,200 candle-power each of the new Wood arc apparatus which is now being built in the new factory of the Fort Wayne Jenney Company in Brooklyn, New York. The arc apparatus is being made under the direct supervision of Mr. James J. Wood, whose work in the electrical field is widely known.

The Middletown Company will put in a 400 horse-power tandem engine of the Curtis type.

Middletown has been a bone of contention among the different electric light companies for the past three or four years, as it has held out against electric lighting. Mr. Morrison is to be congratulated on securing so valuable a franchise and enlisting this amount of new capital in the electric lighting business.

The Boston & Albany Railroad intend to install about 1,000 incandescent lights in their new depot at Springfield, Mass.

Minute Screws.

It is asserted that the smallest screws in the world are those used in the production of watches. Thus, the fourth jewel-wheel screw is the next thing to being invisible, and to the naked eye it looks like dust; with a glass, however, it is seen to be a small screw, with 260 threads to the inch, and with a very fine glass the threads may be seen quite clearly. These minute screws are $\frac{1}{1000}$ of an inch in diameter, and the heads are double; it is also estimated that an ordinary lady's thimble would hold 100,000 of these screws. No attempt is ever made to count them, the method pursued in determining the number being to place 100 of them on a very delicate balance, and the number of the whole amount is determined by the weight of these. After being cut, the screws are hardened and put in frames, about 100 to the frame, heads up, this being done very rapidly by sense of touch instead of by sight, and the heads are then polished in an automatic machine, 10,000 at a time. The plate on which the polishing is performed is covered with oil and a grinding compound, and on this the machine moves them rapidly by reversing motion.

NEW POROUS CUP OF THE NATIONAL GALVANIC BATTERY COMPANY.

Another New Battery.

The National Galvanic Battery Company, of 18 Cortlandt street, New York, has just brought out a new improvement on the old porous cup battery. This perforated cup battery is exclusively for open circuit work. It works instantaneously upon immersion into the sal ammoniac solution. There is no internal action while the electrodes are not united. The platinum connection which they use as well as lead seems to lengthen their life, as platinum is not injured by the sal ammoniac. Users of this new form of battery report that it gives very satisfactory results.

A very interesting and remarkable showing relating to street car traffic by means of storage batteries, will be found on page 15 of this issue. The work was done by the Julien Electric Traction Company.

The Algonquin Club of Boston have asked for estimates for an installation of 1,000 new lamps in their new buildin .

The Telephone in Illinois.

The following facts have been brought to the attention of the law-makers at Springfield, Ill., by the telephone interests of that State:

The telephone companies are now experimenting with copper wires, which will, when introduced, be at greatly increased cost, and also with improved transmitters, in order to increase the distance over which conversations may be carried. They have already met with a great degree of success, and believe if the business in Illinois is permitted to follow its natural course these and other improvements will be introduced, conversation may be made practicable across the entire State, and the telephone become of fourfold value. Such results would be impossible if this or any like bill were passed. We believe the foregoing states no disputed fact. If it does, and attention is called to the item in dispute, convincing proof can be presented establishing the fact. We say then: 1. The telephone business in Illinois is essentially an Illinois institution in which Illinois citizens are largely interested. 2. Plans for a more equitable arrangement of rates than has yet been adopted, and which are the result of careful thought and experience in the business, are now under contemplation by the telephone people. 3. The telephone business is, for a limited time and in the wisdom of the General Government, controlled by patents, which bear as heavily upon the local companies as they do upon the individual subscriber, while the proposed legislation affects only the local industry, which is already under the burden of royalties. 4. Those who have had most experience in the business of telephony affirm that the proposed action will, if adopted, cause a complete destruction of the business in Illinois or cripple it so as to make it of little benefit to any one. 5. The liberal use of capital in new fields is necessary to the progress of the State. If new enterprises are to be subject to arbitrary legislative enactments, the confidence of citizens in the safety of present investments will be destroyed and progress in business cannot be hoped for. 6. The people of the State would suffer from the proposed enactment equally with those who now have their money invested in the business. The latter would be deprived of the value of their present investments, while the former would be deprived for a long time of the benefits of the rapid growth of this industry, which is even now of great service and convenience to the citizens of the State. The people engaged in this business have confidence to believe that the Legislature of the State of Illinois will give this subject the consideration it merits, and will not knowingly do an injustice, nor withdraw encouragement which is so essential to the proper development of this useful industry.

Explosion in an Electric Light Station.

An explosion occurred in the Utica, N.Y., Electric Light works one evening last week. Heretofore an 8-inch pipe 70 feet long has carried the steam from the boiler house to the engine. A large boiler has just been put in, necessitating a 12-inch pipe. The latter had just been put up, some of the joints being held by only two threads. About 80 pounds of steam was let in, when the pipe burst in several places. A portion of the boiler house roof was blown off. The whole plant was filled with steam. The explosion was heard some distance, and stories of a large loss of life spread rapidly. The engineer and two others employed about the building, however, are the only ones injured, and they are suffering only from slight scalds and bruises. The electric lights were out in the whole city that night.

Opinion of Judge Wallace in Regard to Overhead Wires of the Western Union Telegraph Company.

The Western Union Telegraph Company, on behalf of which an injunction was obtained from Judge Wallace, of the United States Circuit Court, restraining the Mayor and Board of Electrical Control from interfering with the poles and overhead wires of the company, met an almost entire defeat in the suit last week when Judge Wallace filed his opinion in the clerk's office of the Circuit Court. He holds, against the argument of the Corporation Counsel, that the United States Court has jurisdiction of the suit. He dissolves the injunction previously granted, holding that the telegraph company is subject to reasonable police regulations by the State, and that the laws relating to the subways are police regulations and are reasonable. He decides, however, that the placing of the wires on the elevated road structures cannot be interfered with. The decision is in part:

The case presents the general question whether certain acts of the municipal authorities of the city of New York, respecting matters of grave local concern, done or about to be done, pursuant to powers devolved upon them by the legislature of the State, are such an invasion of the paramount authority of the national government as to render them unwarranted. Telegraph companies that have accepted the restrictions of the law of Congress of July, 24, 1866, become, as to government business, agencies of the general government, and are given the privilege to "construct, maintain, and operate," lines of telegraph over and along any post-road of the United States, but not so as to interfere with "the ordinary travel" on such roads. All the streets of the city of New York are post-roads, because they are letter-carriers' routes, and all railroads are post-roads. The complainant accepted the provisions of the law of Congress in 1867.

It is not open to discussion that the complainant is protected by the National authority against any encroachment under State authority upon the rights and immunities expressly granted to it by the acts of Congress, or which it enjoys in its dual capacity as an agent of the general Government and an instrument of interstate and foreign commerce. * * * Nevertheless, persons and corporations enjoying grants and privileges from the United States, exercising Federal agencies, and engaged in interstate commerce, are not beyond the operation of the laws of the State in which they reside or carry on their business; and it is only when these laws incapacitate or unreasonably impede them in the exercise of their Federal privileges or duties, and transcend the powers which each State possesses over its purely domestic affairs, whether of police or internal commerce, that they invade the National jurisdiction. The statutes which the defendants are proceeding to enforce unquestionably belong in the category of police regulations, the power to establish which has been left to the individual States. * * It is to be considered whether the statutes in question or the acts of the defendants under them can be defended under the State power of police regulation, or whether what is proposed to be done exceeds in any respect the boundaries of legitimate regulation and encroaches upon the rights of the complainant, founded upon the law of Congress, or incidental to the nature of its commerce.

Judge Wallace says that the law of 1887 is valid, and that the question is as to the reasonableness of the regulation, and whether the losses and inconveniences to which the complainant may be subjected are not such as may justly be exacted of every citizen and property owner for the common good. "It is not apparent," he says, "how the regulation proposed impairs in any just sense the privilege granted to the complainant by the law of Congress." The opinion goes on:

The legislation in question does not contemplate any regulation which is not practically feasible, but what is prescribed, if judiciously enforced can be complied with by the companies operating wires without serious detriment to their instrumentalities. * * * There is serious doubt whether the powers conferred by these statutes are not nugatory to the extent that they permit the complainant to be deprived of its right to maintain and operate its wires upon the structures of the elevated railway. That railway is an independent post road of the United States in legal contemplation, carved out of the streets upon which the structures are erected; and State legislation, under whatever power it may be classified, is impotent to destroy the privilege given by the act of Congress. The power to remove the wires altogether from these structures, and to refuse to permit them to be kept there under any circumstances is not regulation, but is equivalent to a complete denial of the privilege. Inasmuch as the maintenance of the wires of the complainant upon the structures of the railway company is not at present attended with any public inconvenience, and the question is one of sufficient novelty and importance to be considered by the court of last resort, any doubt should be resolved in favor of the complainant for the purpose of its temporary protection.

The Expense of Laying the Brooks Underground Electrical Conductors.

TO THE EDITOR OF ELECTRICAL REVIEW:

DEAR SIR:—Enclosed, I hand you the following information: A telephone company furnishes the expense of laying 1,200 feet of conduit, with 12 ducts, under a cobble-stone pavement, including manholes, at $90 each, at the rate of five manholes per mile, at $1.56 per foot, or $686.40 per mile of duct. This conduit was made of creosoted hemlock, the ducts or spaces three inches square. The full capacity of this duct is for a lead encased cable 2 1/16 outside diameter, two inches inside. The weight of this pipe is five pounds per foot; cost per foot, 24 cents; cost per mile, $1,267.20. We then have cost per mile per duct, $686.40; also 100 wire telephone cable, at 30 cents per foot, or $1,584 per mile, which gives the following:

Duct per mile	$686 40
Lead "	1,267 20
Cable "	1,584 00
	$3,537 60

which, per mile, is $35.37 per conductor.

The foregoing figures contemplate the use of inch boards of hemlock, but if we substitute white pine for hemlock we have to add 66 per cent. to the price of the duct.

Duct per mile	$928 78
Lead "	1,267 20
Cable "	1,584 00
	$3,779 98

This brings the price of the conductor to $37.80 per mile. If pine or hemlock plank is used it brings the price of the conductor to something over $40 per mile.

These are the cheapest kinds of a conduit; but suppose we use an iron pipe, three inches inside diameter, at 22 cents per foot, instead of the wood duct, and into it draw the lead encased cable, we then have:

Iron piper per mile	$1,161 60
Digging, repaving and manholes	582 00
Lead pipe per mile	1,267 20
Cable " "	1,584 00
	$4,594 80

which, per mile, is $45.95 per conductor.

In place of this we will substitute the Brooks system, and use the same size iron pipe:

Pipe per mile	$1 161 60
10 splice boxes, at $3 each.	30 00
Digging, repaving, per mile, per pipe	132 00
The capacity of the 3-inch iron pipe is 2¼ times that of the lead, consequently will take a cable of 225 conductors, relative cost per foot 67½ cents. Per mile	3,564 00
	$4,887 60

which, divided by 225, gives $21.72 per mile per conductor

CONDUCTORS FOR ARC LIGHTING.

A No. 4 strand conductor, covered with three heavy braids, costs about four cents per foot. The market price for such conductors, when drawn into lead, is about 13½ cents per foot, the lead costing in round numbers about twice as much as the copper. Thirty of these conductors can be drawn into a 3-inch iron pipe.

Cost of pipe per mile	$1,161 60
" 30 conductors per mile	6,336 00
	$7,497 60

or, in round numbers, $250 per mile per conductor.

The single lead encased conductor cost per mile $718, which must further be increased when the allowance is made for the cost of conduit.

In the Brooks system the inside of the pipe and its contents undergo no change. The outside of the pipe can be protected from rust by means well known.

How long is a wood-creosoted conduit to last. The life of a fir, creosoted telegraph pole in England is from seven to ten years, so far as regards the portion in the ground. Half of the body of the pole below the surface is then gone, and the balance in an advanced state of decay, but when the wood is in the form of a plank or a board, what will become of that structure about the time that the Bell telephone patent will have expired?

Since the cable of this new system was laid, two years ago, on the Pennsylvania Railroad, there has *never* been an interruption on any of the 53 conductors.

But those using the conduit systems are continually pulling out and tinkering at their conductors.

It is now nine years since I first laid conductors for practical use on the London and Southwestern Railway, London. Those conductors are still working, and Mr. Preece, the government electrician, writes under date of January 15, 1889, that he "has not heard of any trouble with them for some time past."

Instead of using a thick mixture, as now, for insulating the conductors, I used paraffin oil, which leaked through the joints of the pipe to a considerable extent. A defective joint that would cause a leak of a gallon per day then, with the substance I now use would show no leak at all. We remedied that difficulty by sending them the rosin mixture.

The laying of the Brooks system is so simple and easily performed that it is the intention of the company to grant licenses to those who wish to use it, and let those parties do the work.

Very resp'y yours,

DAVID BROOKS.

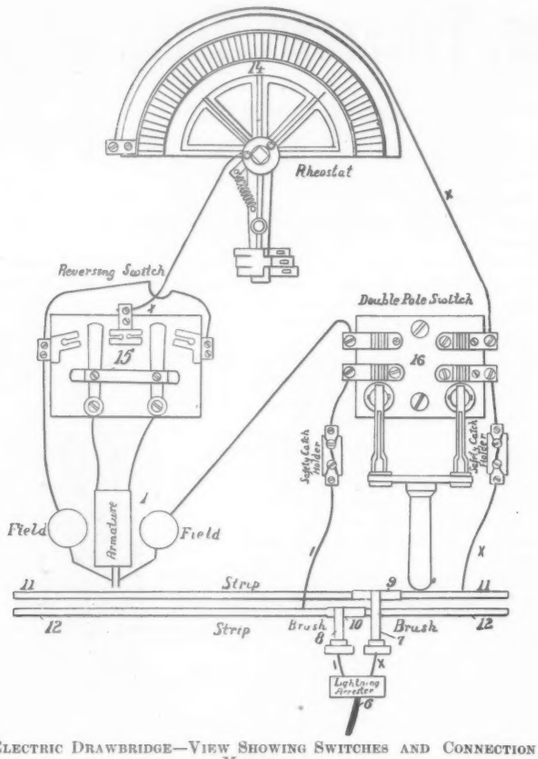


FIG. 1.—ELECTRIC DRAWBRIDGE—VIEW SHOWING SWITCHES AND CONNECTION WITH MOTOR.

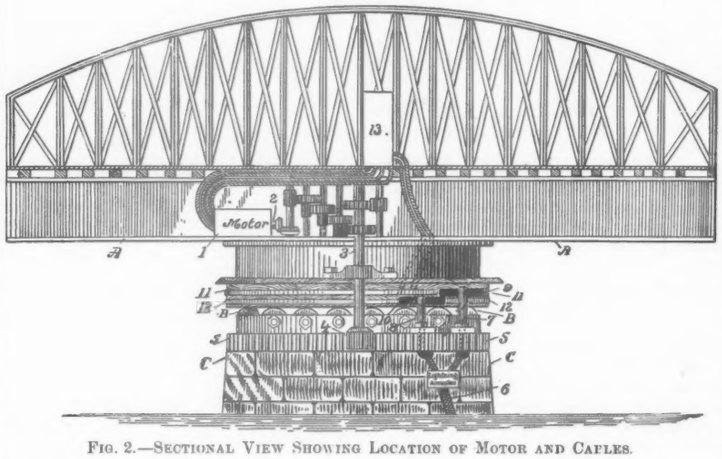


FIG. 2.—SECTIONAL VIEW SHOWING LOCATION OF MOTOR AND CABLES.

Louisville, Ky.—The Kentucky Phonograph Company; the directors are J. B. Speed, Charles R. Long, J. W. Gaulbert, John H. Sutcliffe, H. V. Loving, W. B. Haldeman and W. R. Ray.

St. Louis, Mo—The Porter Electric Company, capital, $40,000, filed articles of association with the Recorder of Deeds. The stockholders are Joseph F. Porter, 360 shares; Charles J. Briner, 30 shares, and James H. Hopkins, 10 shares.

Spokane, Falls, W. T.—The Washington Motor Company; capital, $1,000,000. The incorporators are F. R. Moore, H. Bolster, W. S. Nordman, Cyrus S. Burns. Trustees, D. C. Corbin, John W. Chapman, J. P. M. Richards and William Petti. F. R. Moore, president; John W. Chapman, first vice-president; J. P. M. Richards, second vice-president; John D. Sherwood, treasurer; W. S. Norman, secretary.

Turning Drawbridges with Electric Power.

One of the latest appliances of the electric motor which has excited much interest, not only from its novelty but also the excellence of its operation, is that of the turning of drawbridges. This is a matter to which a good deal of attention has been given both by bridge and electrical men, but it is not until recently that the motor for this purpose has supplanted steam and the slow laborious method of the long lever worked by two or three men.

One installation, the details of which are shown in the accompanying cuts, has recently been made at Bridgeport, Conn., by the New England Electric Supply Co. The drawbridge, which is 180 feet long, 60 feet wide, and weighs 320 tons, was formerly operated by three men, but this method was found to be open to serious objections, and attended by considerable expense, as it necessitated the constant attendance of the men, and under the most favorable circumstances it took six minutes to open and close the draw, which caused a jam on both sides and seriously interfered with the traffic.

The problem of applying electricity as a motive power has been successfully worked out both to the satisfaction of the city officials and the bridge builders. The draw can be opened and closed in two minutes, and the expense is limited to the hiring of one man and the monthly charge of the electric light company, by which a considerable saving is effected.

The details of the construction are as follows:

The current is conducted to the motor through two submarine cables, the core being equal to 4 B. &. S. copper wire which are protected from lightning by two Thomson-Houston lightning arresters. The shore ends are connected to the incandescent lighting current, of the Bridgeport Electric Light Co., by a double pole switch so that the current may be shut off at the pleasure of the draw tender. The other ends are connected to vertical stationary posts which are carefully insulated from the structure, and which carry on their upper ends a pair of brushes which are in contact with two insulated copper bands attached to the circular support on the draw and moving with it.

A rheostat is used to regulate the speed of the motor and a reversing switch to change the direction of rotation of the armature. The armature, rheostat and fields are connected in series.

The double switch, fuses, reversing switch and rheostat are enclosed in a water-tight box in the frame work of the bridge, and are easily accessible from the road bed. The bridge tender has everything under complete control and can easily regulate the speed and the direction of rotation of the drawbridge.

The motive power is furnished by a 7½ horse-power Thomson-Houston motor, securely fastened to the draw by iron braces. One end of the motor shaft is a pinion which drives a train of gears, the last of which turns the shaft formerly operated by the men.

This installation is complete in every detail, its operation is excellent, and reflects much credit upon the Thomson-Houston apparatus. The New England Electric Supply Co. has received much praise from mechanical and electrical engineers for the excellent work they have done here, and has applied for patents on the devices used, and is in communication with several cities which contemplate installations of the same nature.

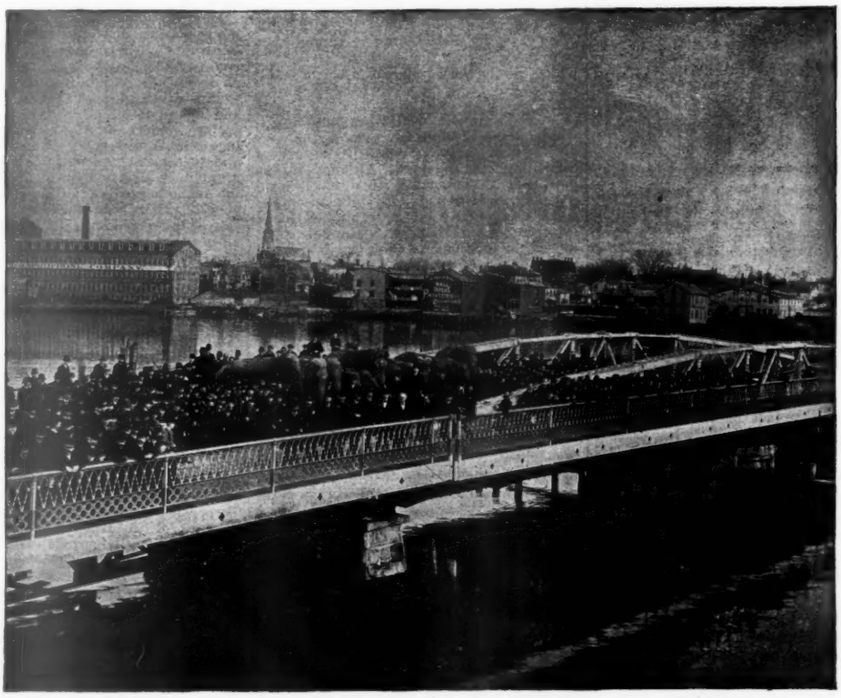


FIG. 3.—DRAWBRIDGE AT BRIDGEPORT USING ELECTRIC MOTOR TO SWING IT.

Cutting Down Electric Light Poles at Middleboro, Mass.

Trouble that has for several days existed between the town authorities and the Middleboro Electric Light and Power Company, culminated April 12th, in open warfare. The electric light people were ordered to stop their work of erecting poles and building lines, but refused to obey. The selectmen began cutting down the poles. Mr. Pettingill, of the Electric Light Company, tried to prevent this by standing on the saw, and was arrested.

Government Telephone Cases.

Attorney-General Miller will, it is understood, appoint Mr. Jenks, at present Solicitor-General, to take charge of the Government telephone cases. It is probable that the somewhat formidable array of special counsel will not be continued. It is doubtful whether the fund available for the Department of Justice would be sufficient for the salaries of special counsel, if they were to be paid on the same scale as they were during the last two years. The interests of the Government will be guarded by this assignment of Mr. Jenks, who has had the general charge of the cases in the Department of Justice, and was the officer of the Interior Department who was especially charged with the law side of the preliminary inquiry in that department which has resulted in the pending protracted and costly investigation. Mr. Jenks is a lawyer of ability, and is familiar with the detail of the telephone litigation.

A Long and Valuable List of Patents.

The Westinghouse Electric Company, of Pittsburgh, own and control a very extensive list of patents, which have recently been arranged in pamphlet form. This list includes patents in probably every branch of electrical work. Among the names of the inventors appearing in addition to the name of Mr. Westinghouse, which appears 13 times, are those of Wm. Stanley, Jr., 33 patents; O. B. Shallenberger, Jr., 43 patents; H. M. Byllesby, 18 patents; Nikola Tesla, 18 patents; Phillip Lange, 18 patents; A. L. Reinmann, 9 patents; C. F. Reinmann, 2; A. G. Waterhouse, 8; F. G. Waterhouse, 4; O. A. Moses, 2; Phillip Diehl, 5; L. B. Stillwell, 2; A. G. Brown, 2; Reginald Belfield, 5, and a number of names with one patent each. Several of the above were associated in the inventions.

In addition to these, which belong direct to the Westinghouse Company, the company is lessee of the following named companies, and of course controls all the patents owned by each: The Sawyer-Man Electric Company (Consolidated), 56 patents; the United States Electric Lighting Company, 294 patents; the National Electric Light and Power Company, 8 patents, all in the name of Otto Heickel.

This makes a grand total of about 570 electrical patents to be credited to the Westinghouse Company.

Chicago, Ill.—Green Bay and Fort Howard Electric Railway and Power Company, at Chicago; capital, $100,000; to build and operate street and dummy railways in Brown county, Wis., supply electric light, heat and power in the cities of Green Bay, Fort Howard and other places; incorporators, H. Ward Leonard, E. M. Izard and M. L. Coffeen.

Spokane Falls, W. T.—Messrs. John H. Stone, J. R. Allen and E. B. Spencer have formed a stock company, to be known as the Washington and Idaho Telegraph Company. The company will do a general telegraph business in the territories of Washington, Idaho and Montana, and will have their headquarters in Spokane Falls. The capital stock is $50,000.

Moorestown, N.J.—The Moorestown Electric Light, Heat and Power Company; capital, $50,000; divided into 2,000 shares at a par value of $25 each. Of the total amount of stock but one-half, or $25,000, is to be issued unless absolutely necessary. The incorporators subscribed for 52 shares, or $1,300. It is proposed to purchase two compound condensing engines of 50 horse-power each, and two dynamos of 500 lights each.

Athens, O.—Athens Gas and Electric Company; capital, $25,000.

Phillipsburg, Pa.—The Electric Appliance Glass Company, of Phillipsburg, Beaver county; capital, $20,000.

Milwaukee, Wis.—The Keelyn Electric Company, of Milwaukee; capital, $1,000; incorporators, James Keelyn, Edward Fitch and W. D. Van Dyke.

Decatur, Ill.—Citizens' Electric Street Railway, of Decatur; capital, $150,000; to operate electric and other street railways; incorporators, William L. Furguson, William L. Shellabarger, John E. Kinney.

Chicago, Ill.—Phœnix Incandescent Lamp Company, Chicago; capital, $100,000; to manufacture electric lamps and other electrical apparatus; incorporators, A. F. Oppermann, E. D. Goff and E. C. Eckstromer.

Wichita, Kan.—The Wichita Steam Pipe Covering Company; capital stock, $50,000; directors, F. E. Parmenter, Jacob Krupp; James McComb and O. M. Sherman, of Wichita, and C. J. Call, of Stafford, N. Y.

St. Paul, Minn.—The Riggs Electric Traveling Danger Signal Company has been incorporated by Joseph W. Riggs, St. Paul, Minn.; Darwin H. Kingsley and J. A. G. Richardson, of Minneapolis. Capital stock, $3,000,000.

Kittery, Me.—The United States Motor Company has been organized; capital stock, $200,000. President, John M. French, Chelsea; treasurer, Charles H. Reed, Boston; directors, John M. French, Charles H. Reed, George A. Walker.

Chicago, Ill.—The American Electric Meter Company, at Chicago; capital stock, $200,000; for the manufacture of electric meters and other materials and merchandise; incorporators, John Marder, E. S. Skinner and R. E. Richardson.

Bedford, Pa.—A company has been formed with a capital stock of $25,000, to light the town and mineral springs by electricity. L. B. Doty, H. D. Tate and John E. Smith are the leaders in the enterprise. The plant will be in running order by the middle of June.

Chicago, Ill.—The Sperry Electric Mining Machine Company, at Chicago; capital stock, $100,000; for manufacturing all kinds of machinery, particularly electric mining machinery; incorporators, Albert L. Sweet, Elmer A. Sperry and Francis W. Parker.

Belleville, Ill.—The National Railway Supply Agency, at Belleville; capital, $100,000; to deal in articles necessary and incident to the construction of steam, cable, electric and other rail tramways. Incorporators, T. B. Wilson, George H. Poor and L. L. Austin.

Chicago, Ill.—Rudd Electric Rapid Transit Company, Chicago; capital, $100,000; for the construction and operation of electric railways, surface, underground or elevated, for express, freight, mail, passenger, and construction and operation of telegraph lines, electric lighting, power and manufacture of electric goods; incorporators, Joseph L. Holbrook, Harlan E. Patterson and W. C. Holbrook.

Portland, Me.—The Union Electric Car Company; capital stock, $1,000,000. It designs to equip street railways with electric power, either overhead, conduit or storage battery systems. The officers consist of Hon. Linus M. Child, president; J. N. Alley, vice-president; Andrew Robeson, secretary and treasurer; Col. E. H. Hewins, general manager, and the above-named, with Messrs. A. L. Richards, George H. Drew, and A. Eastman, directors.

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☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegragh and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, APRIL 20, 1889.

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Has practical, economical, thermal electricity been discovered?

An injunction in the storage battery case of the Electrical Accumulator Company against the Julien Electric Company has been granted in favor of the former company in the U. S. Circuit Court. The injunction is to prevent the Julien Company from making secondary batteries "containing or embodying an electrode consisting of a support coated on one or more faces with an active layer of absorptive substance such as metal or metallic compound, applied thereto in the form of a paint, paste or cement, and practically insoluble in the electrolytic liquid so as to be or instantly become spongy, and thus capable of receiving and discharging electricity, as stated in said letters patent, and from vending to others to be used, or using or causing to be used in any manner any secondary or polarization batteries, thus heretofore constructed by you or any of you; and from infringing the first claim of said letters patent, as limited by said disclaimer, in any way whatsoever."

We are not starring as prophets, but are willing to predict that the year 1889 will see some remarkable advances made in electrical science.

The electric wires of New York are to be cut down this week. And then, if the subways continue to explode, and the steam pipes continue to melt, the lot of the wire owners will be hard indeed.

The executors of the estate of the late Capt. Ericsson, in accordance with his wishes, will present some worthy memorial of the great inventor to Sibley College, Cornell University, in which he was much interested. It has been decided it shall be a bust of the great inventor, and is a duplicate of the one presented to the King of Sweden.

The best wishes of the REVIEW staff and of a host of other friends go with Mr. W. D. Sargent, who sailed for Paris Saturday of last week, to be absent at the Exposition several months. The telephone representatives from other countries will find Mr. Sargent thoroughly informed on every detail connected with successful handling of the business in this country.

Our Pittsburgh correspondent sends us the following interesting information under date of April 11th: A private demonstration was made last night to a few prominent gentlemen of this city (Pittsburgh) of an exceedingly simple device by which the energy in the secondary circuit of an alternating system was increased *one hundred per cent.*, the agent used being *heat* pure and simple.

A very interesting article, prepared for the ELECTRICAL REVIEW by Dr. S. S. Wheeler, electrical expert of the Board of Electrical Control, is published on another page. The history of the recent underground work by arc lighting companies in New York, and the result of many insulation tests, are given at length, and will be of particular interest to every practical worker in the electric lighting field.

Referring to the fact that the Consolidated Gas Company, of New York, on discovering that one of its meters was too fast, had refunded $14.62 to the customer, the *American Gas Light Journal* makes a point against the presumed witty daily press, as follows: "This instance, however, becomes a striking example only because he (we believe he is a hair dresser, with a leaning towards literature) made it public, whereas a similar case happens at least once a week. The really rare bird, however, would be the consumer who, having knowledge that his meter was slow, paid the company for gas that he consumed but which was not registered. There are 20 slow meters in this city to the one that is fast; and if the metropolitan organs wish proof thereof let them apply to the local gas meter inspector. As for a city consumer ever refunding money for unregistered gas—well!"

An accident to one of the employés of the Fort Wayne Jenney Electric Light Company, occurred recently at the company's factory, and, although regrettable in itself, is interesting as showing the exaggerated nature of many of the statements made with regard to the danger of the alternating current. There is no doubt that in this case the man received the full potential of the machine, as he (believing the machine was not running) deliberately seized two brass couplings connecting the machine to the primary of a converter, in multiple with others, and disconnected them from the converter. The result was that he received a severe shock, falling forward, and burning his hands somewhat severely; he did not become unconscious, and after a few seconds, succeeded in getting free. Beyond the burns on his hands and the shock to the system he was not much the worse, and expected to be at work again in a day or two. The machine was delivering current at something over 1,000 volts—probably about 1,050.

MANHOLE EXPLOSIONS CONTROLLED.

The combination of recent events has attracted almost universal attention, in electrical centres, to the explosions which are becoming so common in electrical subways that the public is fast becoming of the opinion that to explode is the natural innate function of a manhole. It is generally admitted that it is next thing to impossible to construct conduits and manholes that shall be gas tight, and it is an equally undisputed fact that no immediate advantage would be derived from making the gas mains tight, for the reason that the earth underlying the streets of the great cities is so thoroughly impregnated with the gas that has already escaped from the mains, that an explosive mixture would continue to be given off from the earth, under varying conditions of temperature, for a long time to come.

It has been said that it is only necessary to ventilate the system of conduits to secure safety from explosion, but the dismal fact remains that systems of ventilation, up to the present time, have not been an unqualified success.

On the other side of the Atlantic it has been suggested, and even tried, to fill the conduits with water. It is possible that some substance having advantages not possessed by air could be used to fill the conduits; for example an artificial atmosphere which would not form an explosive mixture with street gas might be employed. It might not be unwise to experiment with carbon dioxide which has the three-fold advantage of being inexpensive, non-explosive when mixed with street gas and is more than once and a half as heavy as air and would gravitate downward and out through any leaks in the conduit system carrying before it any gases emanating from the earth. Although it is as incapable of supporting life as it is of supporting combustion, yet it is not poisonous, and a suction fan vigorously applied for a few minutes would empty a manhole sufficiently for workmen to enter it. It also has the advantage of being easy of manufacture, in fact a device could be placed in each manhole which would manufacture the gas and automatically regulate its flow.

INTOXICATION BY INDUCTION.

The builders of lines of wires and cables are not the only sufferers from induction, it seems. Nor is electricity the only element that generates induction, for now comes its first cousin—sometimes known as "Jersey lightning"—with strong claims for recognition in this very extensive and always vexatious field, as the following from the *Popular Science Monthly* evidently proves:

"A prominent military man who had drunk moderately during the war and had abstained from that time on, while attending a dinner with his old comrades, where most of them were intoxicated, suddenly became hilarious, made a foolish speech, and settled back in his chair in a drunken state, and was finally taken home quite stupid.

"He had not drunk any spirits and had only used coffee and water, and yet he had all the symptons of the others, only his was intoxication from contagion—the favoring soil had been prepared long ago in the army.

"Another case was that of a man who had been an inebriate years ago, but had reformed. He was recently elected to office, and gave a dinner to some friends. Among them was a physician who has been greatly interested in these studies. He sent me a long report, the substance of which was this: "On the occasion referred to many of the company became partially intoxicated, and the host, who drank nothing but water, became hilarious, and finally stupid with them. He was put to bed with every sign of intoxication, but recovered, and next morning had only a confused notion of these events.

"The third case occurred four years ago. A reformed man, of 12 years' sobriety, went on a military excursion with a drinking company, and, although he drank nothing but lemonade, became as much intoxicated as the others.

"This event was the subject of much comment and loss to him, socially and otherwise, although he protested, and others confirmed his statements, that he did not take any spirits at this time."

The Mexican Telephone Company has elected officers for the ensuing year as follows: President, Robert Colgate, New York; vice-president, Harmon Hall; treasurer, W. F. Smith, Boston; secretary, W. H. Harrington, Boston. The United States office of this company is at 235 Washington street, Boston.

OUR CHICAGO LETTER.

Western Union Telegraph.—This company is rapidly becoming known by some particulars of reputation of a novel character. Last week I chronicled a pigmy row among the boys of the night delivery staff. A day or two ago a man of respectable appearance was discovered to be negotiating forged orders on the company among the unsophisticated denizens of the north side. On Wednesday evening last the manager of the company, Mr. Geo. W. Felton, to the surprise of a large audience at McVicker's Theatre, followed the orchestra up through the cellar door that leads under the stage, and took his seat as conductor, while the regular leader humbly seated himself as first violin. George went through the ordeal like a little man, and at the close of the overture—"William Tell"—received a thundering round of applause. The reason for this little freak was a "stump" on the part of some musicians because George contended that Chicago should have its own orchestra, and it was not supposed he could handle a baton. He did it.

Political Trimming.—For the past two years the vessel and harbor interests have been handled by telephone, the bridges being opened and closed by this means, under the harbor master through an operator. The last election resulted in a change of administration, and it is said that a candidate for the position of harbor master, who held that office under a former mayor, is promising the river interests to overthrow the telephone system if they will aid him to secure the place. It is not likely to be so overthrown, as even the river men are in the majority in its favor.

Electric Railways.—If Chicago does not in the near future have one of these latter day luxuries, it will not be the fault of incorporated companies looking to that end. The last one on deck is the "Rudd Electric Rapid Transit Company of Chicago, for the construction and operation of electric railways, either surface, underground or elevated, for carrying express, freight, mail and passengers, and the construction and operation of telegraph lines, electric lighting and power, and the manufacture of all kinds of electrical goods." There isn't much left. It's like the case of the school boys and the apple. When all in turn had said, "I speak for the core, Jim;" Jim kindly remarked, "*This* apple ain't goin' to have no core."

Chicago Electric Club.—The meeting on Monday night, the 15th, will be the last of the semi-monthly meetings in the present rooms. On that occasion Mr. Fred. De Land will read an historical sketch of the Club—its rise and progress. Thursday, the 18th, the annual meeting for election of officers for the ensuing year will be held. The nominating committee has placed the following regular ticket in the field, from which there will be probably little deviation: President, S. A. Barton; vice-presidents, H. W. Leonard, F. B. Badt, Alex. Kempt, D. P. Perry; secretary, W. A. Kreidler; treasurer, F. S. Terry; managers, B. E. Sunny, F. E. Degenhardt, M. A. Knapp, E. Baggot, H. A. Glasier, Wm. Zimmerman, W. M. Lenhart, Geo. B. Bailey, C. K. Giles, E. A. Sperry; membership committee, C. C. Haskins, W. H. McKenlock, Geo. W. Whitefield, F. W. Parker, J. H. Shay.

For High Insulation.—The following circular has been received by all the electric light people in Chicago, unless by accident omitted from the list:

"From this date no underwriters' or other wire of similar insulation will be passed on inspection within the city limits. This applies to outside as well as inside wiring. C. C. Haskins, Electric Light Inspector."

Chicago, April 13, 1889. C. C. H.

OUR NEW ENGLAND LETTER.

Increased Facilities.—The Billings and Spencer Co., at Hartford, Conn., are building a large addition, 90 feet by 40 feet, to their already extensive works. The increased capacity is demanded by the company's business, which is spreading largely in the electrical field. The new quarters will be used for additional drops in the drop forging work, and for a stock-room. The entire shops are lighted by a Waterhouse arc and incandescent plant, under the charge of Mr. George Matthews.

The Eco Magneto Clock.—The Eco watchmen's clock, in which a magneto replaces the battery used in some older forms, is meeting with a steadily increasing sale.

Acceptable and Accepted.—The electric street railway and electric lighting plant at Southington, Conn., both of which were recently installed by the Hartford Dynamic Company, have given such satisfaction that it has been accepted by the local company, and at the annual meeting of the company the old board of officers were re-elected, showing their course to be satisfactory to the stockholders. The plants are very creditable to the Hartford Dynamic Company, and the experience of Southington will doubtless be repeated by other wide-awake Connecticut towns.

Presentation at Middletown.—Mr. J. P. Stow, secretary and treasurer of the Middletown (Ct.) Electric Light Co., was called

hastily to the station Thursday evening, and on his arrival, instead of finding some serious mishap befallen the machinery, found a gathering of friends, and was presented a fine silk umbrella by Superintendent Putnam in behalf of the employés of the company.

The Connecticut Motor Co.—The new factory of the Connecticut Motor Co. is in active operation and night work is found necessary a portion of the time. Mr. Robert P. Dunstan, the treasurer and general manager of the company, has been one of the busiest men in Hartford during the fall and winter, and the fruit of his toil is now being shown in the excellent types of motors manufactured by the company.

Organization of a New Boston Co.—The Union Electric Car Company has organized by the election of Linus M. Child as president, and A. L. Richards, Andrew Robeson, George H. Drew, E. H. Hewins and John H. Alley as directors. The company's capital is $1,000,000. The offices are at 18 Post Office square. The company is formed for the purpose of building and equipping electric cars, including storage battery cars.

An Interesting Visit.—Your correspondent was recently privileged to go through the extensive manufactory of the Mather Electric and Perkins Lamp Companies, at Manchester, Conn. Under the attentive guidance of Prof. Anthony, the manufacture of dynamos and motors was traced from the beginning to the finished machines ready to be shipped. The laboratory, situated in a separate building some distance away, and in the construction of which no iron, not even nails, was used, is one of the most complete and convenient in the country, and well deserves the praise which has come to it from electricians everywhere. The newly organized Perkins Lamp Company, which is to manufacture incandescent lamps of various voltages and for all systems, has taken the upper floor of the Mather factory, where ample facilities will be afforded for the large business which the company will carry on. Through the kindness of Mr. Perkins, the inventor of the lamp, an opportunity was granted me of seeing nearly the whole process of manufacture, being entertained meanwhile with personal reminiscences of early electric lighting experiences of Mr. Perkins, who was, as is well known, a pioneer in the field. A remarkable showing was made by a dozen lamps of low voltage (50 volts) under a time test. At the time they had been running between 200 and 300 hours, and kept at a normal and uniform brilliancy, yet showed no deterioration nor blackening. A few minutes conversation with Mr. N. T. Pulsifer, general manager of the Mather Company, and Mr. J. J. Gates, secretary of the Perkins Company, developed the fact that there will be no lull in the electrical business so far as these gentlemen and their companies are concerned. T. W. S.

Boston, April 15, 1889.

SOUTHERN ELECTRICAL NOTES.

Electric Lighting.—The Thomson-Houston Electric Company have bought the plant of the Anniston City Land Company, and will erect a new plant at a cost of $40,000.

The erection of an electric plant is now being considered at Atalla, Ala.

A home company has organized at Selma, Ala., and made proposition for the erection of an electric light plant, the Westinghouse system to be used.

The Texarkana (Ala.) Gas and Electric Light Company will put in gas engines to run their dynamos.

Bainbridge (Ga.) is considering the erection of an electric light plant.

A stock company has been formed at Danville, Ky., to establish an electric light plant; capital stock, $5,000; contract is for furnishing the city with 60 lights.

An electric light plant is being considered at Russellville, Ky.

The Electric Light and Power Co., of Greenville, Miss., will make quite an addition to its station, in the shape of a brick building half as large again as the present iron and frame structure.

Tarboro, N. C., will decide by popular vote on the 22 inst., whether or not to issue $5,000 of bonds for an electric light plant.

The city council of Anderson, S. C., have decided to put in an electric light plant. Capacity will be for 1,000 lights.

At Belton, S. C., the Rice Bros. will put electric light machinery in their grist mill.

Elberton, Ala., is stirred upon the subject of electric lights, and it is probable that a plant will soon be erected there.

Telegraph Construction.—Superintendent Kates, of the Postal Telegraph Company, expects to have the lines of that company in operation to Raleigh, N. C., by August of this year.

Burton Electric Heater.—Satisfactory progress is being made in the preparation of the Burton Electric Company, to heat railway cars by electricity, by means of the Burton electric heater. A preliminary test will be made with 30 heaters in the building of the Richmond, Va., *State* office. E. A. O.

Charleston, S. C., April 12.

UNDERGROUND ARC LIGHT WIRES IN NEW YORK.

BY SCHUYLER S. WHEELER, SC.D.

Within the last few weeks arc lights have been put in operation with underground cables for the first time in New York City. The subways which have been in readiness for some time have been found thoroughly practicable for telegraph and telephone wires, and they have been put into use extensively for these wires, there being now upwards of 5,000 miles of such wires drawn into the subways. But the practicability of operating electric lights requiring high pressure currents has been denied on all sides by the electric light interests. Consequently, when the electric light companies became satisfied that they would be compelled to remove their overhead wires from the principal streets of the city within a fixed period, they claimed the right to make a test of the subways and of such cables as could be obtained for the purpose of determining whether their business could be carried on in them, and also to gain some little experience before the final order for the removal of their overhead wires should be given. This demand was met and provided for by giving the various owners of circuits extra time in which to make a commencement by laying cables in a particular locality to form sections of their respective circuits, as these would at the same time serve as a test.

The action taken under this permission for preliminary work has been different in the case of each company, varying with their respective policies and requirements. The Brush Company were the first to take action in the matter, and as they had a number of circuits taking a straight course up Broadway they ordered and laid last August a cable on Broadway from 14th to 35th streets, containing eight conductors which would take eight of their circuits through one tube of the subway.

The next cable was laid in January through 125th street, by the Harlem Electric Light Company over a short route. This cable was completed immediately and put into use, running arc lights. It has been in satisfactory operation ever since.

Single conductor cable was used for this, as well as for all other lines laid, since the Brush cable was ordered. The next cables were short length, laid in February 24th and March 25th respectively by the Manhattan Electric Light Company to connect their wires to Proctor and Turner's Theatre, and to the Union Square Theatre. And last, the current was turned on, April 4th, to the arc light cables laid by the United States Company extending over the triangular route, formed by Broadway, 23d street and 6th avenue, a distance of one and three-quarter miles.

At about the same time the Manhattan Company turned their incandescent current of 1,000 volts into cables laid under both sides of Broadway from 14th to 34th streets, a length of about three and a half miles. All of these cables excepting the Brush have been working continuously since they were started with great success. In the case of the Brush Company's cable, the eight conductors required for the route were made into one cable, because that disposition of the conductors required much less space in the subway. When this cable was submitted to the technical representatives of the Board of Electrical Control, it was at once seen that the insulation between the conductors would be considerably less than it would be if they were made up in separate cables. And apprehending that this might be a point of weakness, a new rule, which was afterwards adopted by the Board and by the Subway Company, was recommended, limiting the difference of electro-motive force, which should be allowed between several wires when made in one cable, to 500 volts.

This required that the opposite "legs" of an arc circuit should be carried in separate cables. It was also suggested that it would be more difficult to attain the same high degree of insulation between conductors thus enclosed in one covering. Being the first heavy cable of the kind ever laid, a longer time was consumed in completing it. Since completion it has been tested with the greatest care with the following results, and possesses, as may be seen, a high degree of insulation, notwithstanding some reports to the contrary which have appeared in the press:

TESTS OF BRUSH EIGHT-CONDUCTOR CABLES BY WM. MAVER.

LENGTH OF CABLE, 1.15 MILES.

INSULATION BETWEEN EACH CONDUCTOR AND GROUND.

No. of Cond.	Total Insulation Resistance.	Insulation Resistance per Mile.
1	380 Megohms.	414 Megohms.
2	380 "	414 "
3	400 "	460 "
4	360 "	414 "
5	400 "	460 "
6	400 "	460 "
7	288 "	331 "
8	262 "	301.2 "

INSULATION BETWEEN EACH CONDUCTOR AND ALL THE OTHER CONDUCTORS CONNECTED TO GROUND.

No. of Conductors.	Total Insulation Resistance.	Resist. per Mile.
1 with 2,3,4,5,6,7,8, to ground.	350 Meg's.	402 Meg's.
2 " 1,3,4,5,6,7,8, "	350 "	402 "
3 " 1,2,4,5,6,7,8, "	350 "	402 "
4 " 1,2,3,5,6,7,8, "	350 "	402 "
5 " 1,2,3,4,6,7,8, "	350 "	402 "
6 " 1,2,3,4,5,7,8, "	350 "	402 "
7 " 1,2,3,4,5,6,8, "	87 "	100 "
8 " 1,2,3,4,5,6,7, "	77 "	88 "

The delay in putting this cable into use has resulted from the fact that while the insulation of all of the conductors of the cable is fairly good, the last two conductors do not possess an insulation quite as high between wires as is required by a strict interpretation of the stringent rules of the Board.

The line in 125th street, 2,000 feet in length, is laid in the small ducts of the Johnstone system of conduits. The cable is a white core Bishop's gutta percha cable, which was found ready in the market, and was laid immediately after the order for the work was given. The cable was connected to overhead arc light wires by running it up in a two inch iron pipe fastened to the outside of an ordinary city electric lamp post. Connections were made with lights in front of stores by carrying the cable from the ducts in iron pipes under the sidewalk and up the fronts of the stores. This line has been in continuous use for two months, carrying a pressure of 2,500 volts, and it shows an actual rise in insulation with age and use, as will be seen from the following test:

Jan. 11th, 1,100 megohms.
Feb. 11th, 1,800 megohms.
April 12th (including eight arc lamps and branch leads), 2,600 megohms.

The cable laid in Sixth avenue and 24th street, 1,200 feet in length, to connect with Proctor & Turner's Theatre has been in continuous use since February 24th, carrying 1,200 lights, with an alternating current of 1,000 volts. The tests of this show insulation as follows:

Feb. 24th, 150 megohms.
March, 300 megohms.

The cable was laid in a special conduit in 24th street, which was built in three days after permission for overhead connections had been refused. The cable used was partly Bishop's and partly that of the Standard Underground Cable Company.

The cable in 4th avenue, 220 feet in length connecting the Union Square Theatre, was also laid in a special conduit built for this purpose within one day. In this place the Safety insulated cable was used and the current carried is 1,000 volts alternating, supplying 1,300 lamps.

This cable when on the reel before laying tested 9,000 megohms. Immediately after laying tested 100 megohms weaker, being damp; now it tests uniformly.

TESTS OF THE MANHATTAN ELECTRIC LIGHT CO.

Location of Cable.	Weather.	Megohms.	Megohms Per Mile.	April | Date.
B'way, 14 to 46, W. side | 25 to 34, E. " |	fair.	370	1110.	3
" with 15 converters in....	clear, warm	22.2	66.6	4
" in service over night.....	clear & fair	18.2	54.6	5
" with pole lines.	clear	12.85	321.	8
" " "	clear	13.3	332.	9
" with 24½ miles of pole lines all in.....	clear	8.93	279.	10
" and additional houses connected.....	fine	9.	282.	11
" with cross connection at 17th 25th and 27th sts., pole line to 80th st. and Ave. B, and 20 converters & subsidiary connections..	mild, damp	9.13	.....	13
" " "	clear & dry	10.	.....	15
Cable on 6th ave., 25th to 33d sts., and on 28th st. from 6th ave. to B'way, length, ½ mile. No subsidiary connections..3.....	fine	2500.	1250.	14

The United States Company wishing to make a test of the subways and cables for arc lighting, laid three cables on Broadway from 30th street to 23d, through 23d to 6th avenue to 34th street, and down Broadway to 30th street again, to join their pole line which extends through 30th street from Broadway to their station. Wishing to include a test of lamp connection, they mounted 10 arc lamps on the gas lamp posts, and led the wires up from the subway, through the inside of the posts. These lamps were all connected to one circuit. The reason for laying three cables was that it was easier to draw the others into the tube with the first cable than to draw them in separately afterward. The tests of these three cables when completed were: No. 1, 3,400 megohms; No. 2, 2,266 megohms; No. 3, 2,266 megohms. When the loops of cables for running up the lamp posts were connected to cable No. 1, the cable tested 588 megohms.

This reduction was owing to the many ends of the cable so formed being exposed to the atmosphere at the tops of the lamp posts. After the lamps were connected in the cables tested 111 megohms, the reduction being due to the increased effect of the same cause, *i. e.*, exposure. Enough current was then turned on to light the 10 lamps as an experiment, and as the tests the following day showed an increase of insulation, the electro-motive force on the circuit was raised by adding lamps in the station until by successive increases each day the pressure was brought to the maximum of 50 lamps. The insulation was found to increase almost regularly each day, as follows:

TESTS OF UNDERGROUND ELECTRIC LIGHT CABLES OF THE U. S. CO.—ELECTRICAL EXPERT'S DEPARTMENT.

Location of Cable.	Weather.	Megohms.	Megohms per mile.	Date.
Cable No. 1.—B'way., 23d street, 6th avenue and 34th street. Length, 1.74 miles....	Clear and cold.	3,400	5,780	March 30
" With connections up lamp post.....	Clear.	650	1,131	April 4
" Ten lamps connected in.....	Clear and fair.	111.1	193.3	" 5
" Aerial line, 1.98 miles, 90 megohms.	Threatening.		251.2	" 6
" Aerial, infinity.....	Warm and dry.	275	478.5	" 8
" Aerial, "	Clear and dry.	323	562	" 9
" Aerial, "	Clear and pleasant.	175	304.5	" 10
" Aerial, not tested.....	Clear and warm.	375	652.5	" 11
		Ohms.		
" Lamp connections wet, { 9 A. M. / time of testing. { 10 A. M. / 10.45 A. M. / 4.30 P. M.	Threatening.	610,000	1,661,400	
	Rainy.	330,000	348,000	" 12
	Rainy.	61 000	106,140	
		Megohms.	Megohms.	
" Lamp wires newly paraffined.....	Overcast.	2.5	4.35	" 12
		Ohms.		
" Lamp connected to cable.....	Overcast.	66,000		" 13
		Megohms.		
" Lamp not in circuit.....	Overcast.	150	261	" 13
" Lamps hung on insulators.....	Cloudy.	250		" 14
" " " "	Dry.	309		" 15

The policy of the Manhattan Electric Light Company being to push ahead with their business on an all-underground basis where possible, they went ahead at once, and laid pairs of conductors on Broadway from 14th to 42nd streets on the west side, and from 18th to 25th streets on the east side, and on Sixth Avenue from 18 to 58th streets. Of these lines the following were connected up on April 3d, and supplied with the alternating current of 1,000 volts from their station at 80th street through wires strung on the new model overhead electric light line on First avenue: "West side of Broadway, 14th to 32nd streets; east side of Broadway, 25th to 34th streets." The total length of the cable, about three and a half miles when connected up, had an insulation of 370 megohms, which was reduced to 22 megohms when the converters and other appliances were connected on. The subsequent tests given below have been made without disconnecting the 14½ miles of overhead wire leading from the station to the subway, and they show a decrease of insulation proportionate to the increase in the number of connections made from day to day.

Twice in damp weather the insulation was found to be temporarily very low, and this was proved to be caused by the exposure of the lamps and the ends of the cable, to the weather, whereby these portions of the underground system were subjected to the same loss of insulation that occurs in all overhead lines in such weather. This was proved by warming and drying the connecting wires at the lamps, by which the insulation of the whole line was completely restored, the weather being still damp. And it seems to be a proper conclusion that the only part of an underground line that will not maintain a very high insulation during storms is the part that is exposed for the purpose of making connections.

The tests made at the same time with the first-class overhead wires, used to connect the underground wires, showed that their insulation invariably fell in damp weather far below that of the cables, even when the latter were reduced by the dampness of the terminals, while, as stated before, when these terminals were properly dried the cables tested nearly as high in stormy as in dry weather.

Telephonic News

*** Asheville, N. C., is to have a telephone exchange.

*** Newport is happy over the opening of a long distance telephone office in that city.

*** The telephone exchange at Stamford Conn., is arranging to move in a new and more convenient building.

*** The Highland Improvement Company, of Helena, Ark., are negotiating with the Erie Telegraph and Telephone Company, for the building of lines to Memphis, and other lines.

*** The Biddeford, Me., city council has voted to adopt the electric fire alarm system. The matter was left to the chief engineer and a committee of five of the department to purchase the apparatus.

*** A gentleman named George V. Sheffield, of Schenectady, has invented a printing telegraph machine which has an attachment for making an audible signal for each letter printed, so that the message may very easily be read by sound.

*** The telephone in the Mayor's office, Harrisburg, having been removed for nonpayment of rental—the Mayor claiming that the free use of the city's poles was a sufficient off-set—the police have improvised a phone with a cord and an empty wine bottle.

*** The contact of a telephone wire with an electric motor line wire at Council Bluffs, Iowa, came near causing a fire in the opera house block last week. The telephone was burnt out, and some papers were set on fire, but the blaze was seen from the street, and extinguished before much damage was done.

*** Manager M. F. Burke, of the proposed Asheville, N. C., telephone exchange, is inspecting the telephone poles furnished by contract for the erection of the wires in that city. The entire outfit for the service has been shipped from New York, and the construction of the line will be pushed through to an early completion.

*** City Counsellor McGrath, of Detroit, has commenced two suits against the Western Union Telegraph Company and the Telegraph and Telephone Construction Company, asking the Circuit Court to compel the companies to place their wires underground. The Board of Education has begun a suit against the same companies and the Michigan Bell Telephone Company to have the wires taken away from the high school, where they are considered a nuisance.

*** "The telephone is undoubtedly a wonderful invention," said a well-known inventor yesterday, "but it has its disadvantages. My wife had been away from home for a long time, and her recent return demonstrated this fact to me. My telephone is placed in my bedroom in order that urgent night calls may reach me. Once upon a time I called up a party and was answered from the central office by a soft, sweet voice. I could not resist the temptation, and I asked, 'Is that you, dear?' She answered sweetly, 'Yes, love.' Well, that started it. She used to wake me by calling me up every morning about 7 o'clock, and we would have a little flirtation over the wire before breakfast. I tell you I enjoyed it. When my wife returned home I forgot all about the telephone girl. The next morning the bell rung as usual, and my wife, who was dressing, answered it. I felt what was coming, and I hid my head under the bed clothes. 'What's that?' I heard my wife ask sharply. 'No,' she proceeded, 'this is not your dear, this is your dear's wife.' Well, sir, I never got another love message from the girl. What did I get from my wife? Oh, we'll let that pass."

The New England Electric Exchange.

ANNUAL MEETING OF THE EXCHANGE IN BOSTON LAST WEEK—ADDRESSED BY PRESIDENT ALEXANDER, S. E. BARTON AND M. J. PERRY.

The annual meeting of the New England Electric Exchange was held April 8th, at the rooms of the Electric Club, Boston, and was well attended by representative men. President P. H. Alexander called the meeting to order and reviewed the work of the Exchange in a brief address as follows:

Gentlemen: It is just a year since the New England Electric Exchange has been formed, and it is but proper that we review to-day, its first anniversary, the work that has been done by it.

Many of you who are here to-day will doubtless remember the meeting held the 9th day of April last year, the difficulties we had in laying out the work of this exchange, and the hopes and fears that were expressed for its future. Few, or none of us, probably, thought at that time that opposition would arise to the institution that was created purely and solely for the purpose of elevating electrical work, so far as it relates to light and power, and we thought that an immense interest must be felt by every one engaged in our business, and that they would stand shoulder to shoulder, helping each other to attain the results wished for by this body, and the results, while increasing the general electric light business, would, of course, also prove beneficial to them. But, gentlemen, we were somewhat mistaken in our expectations.

In the first few months of our existence, the purposes and motives of this institution were misunderstood, and attacks upon this exchange were of frequent occurrence. While it is true that all the objectors have receded from the position taken, after investigating thoroughly the work that had been done and was contemplated to be done, it is nevertheless true, that many men who at the outset showed so much interest in the objects to be gained by this organization, have let their interest cool from month to month, and have left the burden that was necessary to be borne, to be carried on the shoulders of a few strong men, who have sacrificed self-interest to the interest of the whole.

A further appreciation of our work by outside parties is best shown by the attention given to the report of our exchange, read before the National Electric Light Association meeting, held at Chicago, last February, and the action taken by that body in appointing a committee to report at the semi-annual meeting of the National Electric Light Association, to be held next August, upon the following resolution:

"To recommend some means that would secure to the National Electric Light Association the same advantages now obtained by the New England Electric Exchange regarding the pleasant business relations between the electrical and insurance interests."

One hundred and seventy-five men have so far applied for licenses, 150 of whom were examined; 144 were granted certificates, 68 of whom, however, obtained a lower grade of license than they applied for, and 4 secured a higher grade; while 6 men were rejected as totally unfit to carry on the business. It will interest you also to know that of 59 who applied for first-class licenses, 48 were examined, and only 29 granted a first-class certificate; of the 61 who applied for second-class, 52 were examined, and only 35 obtained the class of certificate desired. To show how ambitious some of them are, I would say that 5 of them made a second application for a license, higher than that first obtained, thus showing that they had been studying up the subject with a view of perfecting themselves in the art; and I am happy to state that 4 out of these 5 have been successful in obtaining a higher class of license than they secured at their first examination.

The reports of Mr. H. B. Cram, secretary and treasurer, was read and approved.

The treasurer's report for the year ending April 8, showed receipts, $592.00; disbursements, $564.87; leaving cash in hand, $27.13.

The dues of the exchange were on motion increased from $3.00 to $5.00 per annum.

Officers were elected as follows for the ensuing year:

President: P. H. Alexander.

Secretary and Treasurer: H. B. Cram.

Directors: Frank Ridlon, Andrew Robeson and J. Y. Bradbury.

Mr. Marsden J. Perry, of Providence, was then introduced and spoke as follows:

MR. PERRY'S ADDRESS.

Gentlemen of the Electric Exchange, if you were to bring a charge of gross misrepresentation in this case against your president, I am quite sure you would get a verdict, for one day I happened in the office of your president, and he asked me to prepare a paper to be read at this meeting. I replied that I was much too busy to undertake such a task, besides which I was only a business man and had received no scientific training, so I declined; but I subsequently received an intimation that my paper had been announced, and so I had to come forward and tell you as well as I can what we are proposing to do at Providence to meet the requirements of our increasing business there. Our engineer, Mr. Henthorn, has kindly prepared me these diagrams (which covered the entire end and part of the side walls of the room), and that gentleman being present now, he will be pleased to give any explanation that you may require, after I have said all I can myself.

When I took hold of the electric light plant at Providence in 1884, I found there were two boilers and two Armington & Sims' engines which represented the steam-plant. The company had been established by Mr. Goff, and at that time he had only 25 commercial lights. Our competitor in the field had something like 175 commercial lights. Of course, we wanted all the business we could get, and at the end of four months we had secured sufficient business to warrant us in building a new station. So we erected a building 180 feet long, which did for a time, but four years afterward we are having to rebuild. We find we have to take up and deal with this question on an entirely business basis, and in a manner that will stand good for at least 25 years to come First, we had to buy a piece of land which, of necessity, we required; and we located by the waterside for convenience in handling our coal. We then had to decide what should be the shape and size of our station, what amount of land we should cover, for we preferred to keep to the ground, rather than build up in the air.

After carefully considering the matter, we decided on building a dynamo-room 200 feet by 60 feet, a boiler house 65 feet by 70 feet (plans of which were exhibited). In time, such changes as become necessary will be made as will afford us more space and increased facilities. We shall have four or five batteries of boilers aggregating 6,000 horse-power capacity, from which statement you will infer we mean business. The chimney stack is about 231 feet high, octagonal in shape and eight feet, six inches in diameter. The object of making the chimney so high is to get the benefit of a Greene Economizer, a device manufactured in England, from which we believe we shall derive great benefit by taking the gases from the boilers. We shall get a good, strong draught, and that is our object.

Now, the first dynamo-room is already roofed in. It is a brick building having a roof of somewhat peculiar construction. To prevent all possible condensation from the difference of temperature on the outside and inside, we have constructed it as follows: The rafters are of iron; on them are placed wire netting, then two thickness of tarred paper to prevent damp, and above that a thickness of asbestos, the whole being covered in with corrugated sheet iron. Pointing to a sectional drawing of the dynamo-room as it is at present, Mr. Perry said: It is intended, when we want to enlarge by building another dynamo-house, to take down the wall, and have a room 200 feet long, without a column in its entire length. We shall build the boilers right up to the engine-room, so that the steam can pass direct from the boilers to the engines. The steam mains will be 18-inch wrought-iron pipe, with flanges turned on the pipe itself, and with cast iron put in between at the joints, so that they can be readily caulked up. In the dynamo-room we have put our dynamos so that the operator can walk up the middle, and see the commutators of eight machines at one and the same time.

On our main shafting we shall use split-wood pulleys with iron spiders. We are now considering two devices for driving the dynamos, and we shall use belt shifters. The main line of shafting will be cut up into sections with cut-off couplings. The main receiver will be mounted on a quill, so that with a clutch we shall be able to drive the whole line or a number of sections at a time from any one engine that may be required. We are also considering the adoption of a paper friction device. As I have already remarked, the trusses of the roof are all iron; the windows are made in three parts to insure abundance of light and air.

Our engines will be built by E. P. Allis & Company, of Milwaukee, Wis., and will be of the Reynolds-Corliss type, that being proved to be the best type made, having triple expansion with condensers. The first engine will be of 500 horse-power capacity. That, we anticipate, will soon be insufficient; then we shall have another one, and a third as a reserve. The next engine we have we anticipate will be of 1,000 or 1,500 horse-power capacity.

The pressure at which we propose to work them will be 160 pounds, though our boilers are tested up to 200 pounds. The condenser will embrace some rather novel features. It will work independently from the main shaft. We shall also have a circulating pump, feed pump and air pump, all working from the same shaft. The engine itself will have an eight-foot fly-wheel, and a vacuum pump will control the speed of the engine. To determine the amount of water supplied to the boiler by the circulating pump, there will be a column of mercury in which will float an iron weight connected with the cut-off of the engine; this, too, will maintain the temperature in the condenser. The feed pump will be controlled by a float in the boiler, and will be connected by a link motion. When the water line is about at its proper height it will act on the float so as to cause the pump to remain stationary. That is expected to maintain the water within an inch, which is near enough for all practical purposes.

The advantages we expect to derive from locating by the waterside are that we get free water supply, besides which we can run coal barges right alongside our works and trim our coal directly from the barge into our coal pocket and very nearly at our furnace doors, as you will see from this diagram (pointing to a sketch of the discharging apparatus and coal store).

Usually there are so many inconveniences and expenses attending the trimming of coal, etc., at electric light stations, which expenses have to be charged to consumers, and invariably lead to unpleasantness.

The type of boiler we have adopted is the Babcock and Wilcox, with National Feed Water-Heater.

Our station will be practically fire-proof throughout, and you will see by the diagrams that our storage for coal is so planned that should our coal ever take fire it can burn itself out without doing damage to the other buildings.

I may say that the cost of building the coal store of iron has been about $8 per ton, whereas to have built it of wood would have cost $3.50 per ton. The chimney will be octagonal with pilasters at the corners. On the inside the core rises entirely independent of the shelling, so that, with cross-bars, a man can climb up with ease when necessary. We shall have a lightning-rod on the chimney. This will be let into the earth at its lower end until we find two or three feet of water.

Of course we recognize that we are doing a bold stroke in what we have undertaken, because we don't know as yet what are going to be the developments of electric lighting in the future.

The condensing apparatus will be put in in sections; at first about 1,800 horse-power. Other sections will be put in subsequently. The engine itself is quite a hero in engineering, for the makers guarantee us one horse-power from every 12$\frac{1}{2}$ pounds of water, which is the lowest guarantee ever made with any engine. Other makers guarantee from 13 to 15 pounds of water per horse-power, which is a striking difference with the guarantee made to us, leaving the makers of other leading engines a wide margin for improvement.

We are considering how to drive all the dynamos by friction Instead of pulleys we shall have a series of paper friction discs which will be operated by an iron lever, by means of which, when the pressure is removed, the load is removed at the same time. Of course under this plan there is an amount of extra friction, but we believe we can succeed in the method of operation.

After some discussion, Mr. S. E. Barton spoke in substance as follows regarding the insurance of central stations:

I think an electric light station ought to be as good a risk as a well-equipped machine-shop. We were told, three or four weeks ago, that the fears and objections of insurance men were not well grounded. A great many of them have not set aside their fears and prejudices against electric light stations, but ask themselves if it is well for them to entertain risks from this class of business; for when they look round and examine them, they find no two alike, and they find them constructed in the manner in which I have spoken of, and in the most unsafe place. I can call to mind many myself in corners crowded in among other dangerous factories; cramped up against 100 horse-power boilers, having chimneys intended, probably, for coal stoves; arranged as unsatisfactorily as one can imagine. Then you have gone on with the insane idea of making things in the same unsafe manner, even after seeing the advantage of doing otherwise, all because you wanted to make your place as pretty as possible, and in doing that you have covered up every point of safety. I have in mind one particular station which was satisfactorily arranged in every way, but for appearance's sake the dynamo-room was subsequently sheathed throughout with white pine. A small accident, as you know, soon demonstrated the want of wisdom thus shown. There are too many buildings constructed that way, where safety is entirely sacrificed. The very same idea possesses to many of the community on the overhead wire question. They are so overcome with the unsightliness of the wires, that they want everything to go underground. I don't see any reason for such a demand, and that is the reason for the position I have taken on this question. I say the detriment that would ensue to the electric lighting business would be a hundred times greater than the inconveniences of overhead wires.

Ayrton & Perry's Secohmeter and Secohmstandard.

This instrument consists of two rotary commutators, each with four stationary brushes. The commutators are on the same spindle, one at the front and the other at the back of the secohmeter, but for convenience they are shown in the accompanying diagrams as if they were in the same horizontal plane. One commutator, *G C*, is for periodically reversing the galvanometer connections, and the other, *B C*, for reversing the battery connections. An adjustment is provided for enabling the relative positions of the two commutators to be varied so that both reversals can be made to occur simultaneously or one a little before or after the other, or one reversal midway between two successive reversals of the other.

The commutators can be driven at one or the other of two speeds relatively to that of the driving handle. With one arrangement there are rather more than 8 reversals of both the galvanometer and of the battery for one revolution of the handle, and with the other 24 reversals of each for one revolution of the handle.

To shift from one speed ratio to the other, press down the end of the locking lever at the right of the secohmeter, and slightly push in or pull out the handle, turning it slightly to assist the toothed wheels engaging properly; when engaged let go the end of the locking lever.

1. To compare two co-efficients of self-induction. Join up the apparatus as in Fig. 1. The continuous lines indicate permanent connections on the secohmeter itself; the dotted lines temporary connections outside the secohmeter. Then if the resistances r_1 and r_2 be adjusted to give balance with a steady current, balance will also be obtained on rotating the secohmeter open.

$$\frac{L_1}{L_2} = \frac{r_1}{r_2}$$

L_1, L_2 being the co-efficients of self-induction of the inductive branches. The speed at which the secohmeter is driven need not be known, but the greater the speed the more sensitive the test; the rate of reversal must not however be too great for the currents to reach their steady values between two consecutive reversals of the battery.

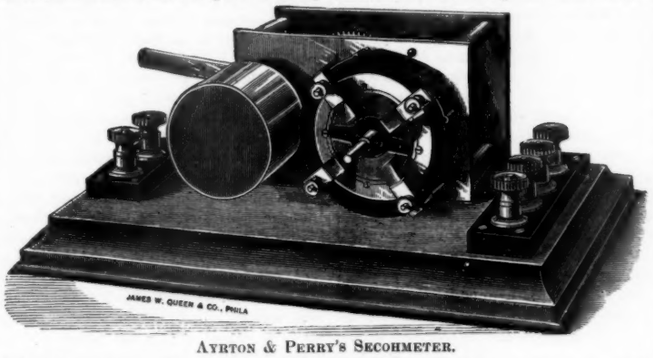
2. To compare two capacities. Join up the apparatus as in Fig. 2, then balance will be obtained on rotating the secohmeter when

$$\frac{F_1}{F_2} = \frac{r_2}{r_1}$$

F_1 and F_2 being the capacities of the condensers, and r_1 and r_2 the resistances of the non-inductive branches of the bridge. As before, increasing the speed at which the secohmeter is driven merely increases the sensibility of the test without affecting the ratio connecting the capacities with the resistances.

3. In similar ways two co-efficients of mutual induction may be compared with one another, or a co-efficient of mutual induction with a co-efficient of self-induction or either of these co-efficients with the capacity of a condenser shunted by a non-inductive resistance.

4. To measure a co-efficient of self-induction absolutely in secohms—a comparative deflection method. Attach a speed indicator to the commutator spindle, which is prolonged for this purpose, and join up the apparatus as in Fig. 3, L being the co-efficient of self-induction to be measured and r_1 r_2 r_3 values of the three non-inductive resistances which give balance with a steady current. Rotate the secohmeter handle at some convenient speed, causing the commutator spindle to make n revolutions per second, and observe the steady deflection d_2



AYRTON & PERRY'S SECOHMETER.

of the galvanometer. Next *stop* the secohmeter and increase or diminish one of the resistances, for example r_1, by a small amount ρ ohms, obtaining a steady deflection d_2 of the galvanometer with the battery previously used, then

$$L = \frac{d_1}{d_2} \frac{r_2}{r_3} \frac{\rho}{4} \text{ secohms approximately.}$$

For this test the relative positions of the two commutators is unimportant, they may be as in Figs. 1 and 2, in which case the reversal of the galvanometer occurs midway between two consecutive reversals of the battery; or they may be as in Fig. 3, in which case the reversal of the galvanometer just precedes the reversal of the battery. The greater the value of n the greater will be the deflection d, and the more accurately can it be read, but the speed must not be too great to prevent the currents reaching their steady values between two consecutive reversals of the battery. Whether this condition be fulfilled can be best ascertained by seeing whether the same value is obtained for L for a speed considerably smaller than n.

b. More sensitive zero method. Instead of obtaining two deflections, the resistances r_1 r_2 r_3 are first adjusted to give balance with a steady current, and then one of them, say r_1, is altered by an amount of ohms so that there is still no deflection of the galvanometer when the commutator spindle makes say n revolutions per second, then

$$L = \frac{r_2}{r_3} \sigma \frac{n}{k} \text{ secohms approximately.}$$

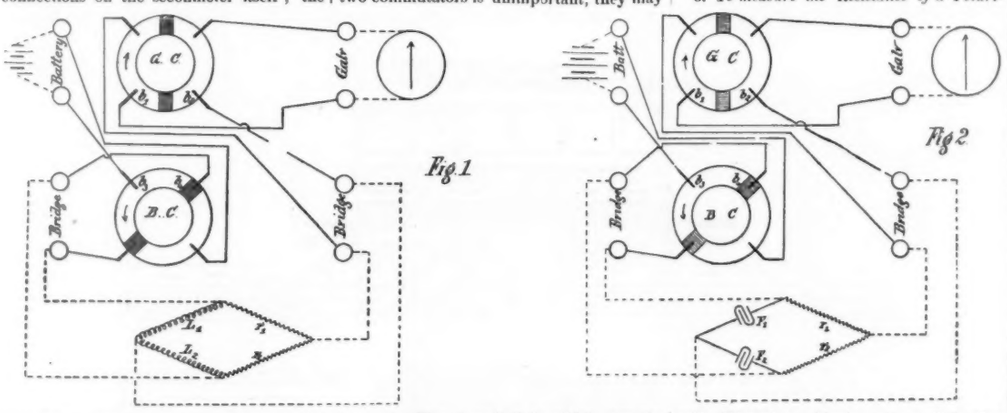
Where k is a constant depending on the relative positions of the commutators. The value of this constant k is most accurately ascertained once for all for a given relative position of the commutators by experimentally determining the value of $\frac{r_2}{r_3}\sigma$ that produces balance for a known co-efficient of self-induction when the commutator spindle is driven at n revolutions per second.

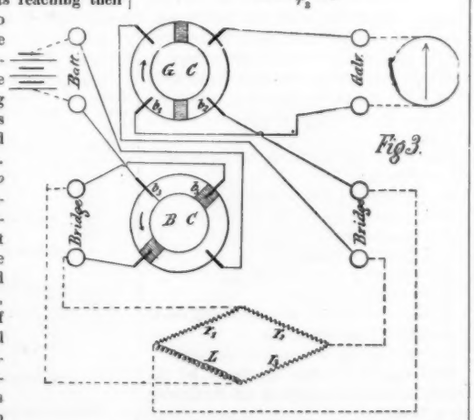
With the zero method of measuring a co-efficient of self-induction absolutely, it is necessary that the commutators be so placed relatively to one another that the galvanometer is not reversed exactly midway between two consecutive reversals of the battery, since with this latter adjustment no variation in the resistance of any of the arms of the bridge can counterbalance the effect of the self-induction on rotating the secohmeter handle; in fact, the more nearly the commutators are placed in the midway adjustment, the smaller will be the value of k and, therefore, the larger the value of $\frac{r_2}{r_3}\sigma$ to produce balance for given values of L and n.

5. *To measure the Resistance of a Polarizable Electrolyte.* Replace the coil having self-induction in Fig. 3 by the polarizable electrolyte, adjust the commutators so that the galvanometer is reversed just before the battery, and, using the proper speed ratio for the gearing, rotate the secohmeter at the highest convenient speed, then if x be the true resistance of the electrolyte

$$x = \frac{r_2}{r_3} r_1.$$

Messrs. James W. Queen & Company, of Philadelphia, are the agents for these instruments.





TELEGRAPHIC

.... William J. Syms, who made a fortune during the War by selling small arms to the Government, is dead. He was the organizer and president of the old Franklin Telegraph Company. He also organized the Atlantic & Pacific Telegraph Company. Both these companies were captured by the Western Union, and Mr. Sims became one of the directors of that company.

.... The repairs and improvements in the office of the Electric Time Company, Ansonia, located in the rear of Keene's jewelry store, are well under way, and when completed will make a much neater appearance than formerly. The wires now come into the office in cable form, instead of each circuit upon an independent wire as formerly.

.... The storm of April 6 badly interrupted electrical communication around Washington, D. C., and workmen were busy repairing damaged telegraph and telephone wires. The telegraphic situation was particularly bad south of Washington. There were 384 poles down between Alexandria and Fredericksburg, Va., and 150 of them in a stretch of country about five miles in length. In other sections South the wires were in no better condition.

.... Secretary Moss, of the Board of Electrical Control, has received a letter from General Manager W. H. Eckert, of the Metropolitan Telephone and Telegraph Company, saying that the company had completed the work of placing its underground cables in the subway in Forty-second street, between Sixth and Madison avenues, and that the conductor in the cables had been put in service, taking the place of the overhead wires between the points mentioned.

.... General Eckert, general manager of the Western Union Telegraph Company, said that he had not been informed officially of Judge Wallace's decision vacating the injunction. Until he had read the decision it was impossible to say what the company would be likely to do now. R. M. Gallaway, vice-president of the Manhattan Elevated Railway Company, thought that the decision that the city could not interfere with the wires of the Western Union Company on the elevated roads, would answer all the purposes of the company.

.... Judge Wallace says that while the complainants say the subways are defective, the defendants deny that they are, and as the city authorities are apparently acting in good faith their determination is conclusive. He closes: "An order will be entered denying an injunction and vacating the stay heretofore granted as respects the removal of the complainants' poles and wires from the streets, and granting an injunction against any interference by the defendants with the complainants' use of the structures of the Manhattan Railroad Company for operating and maintaining its lines."

.... The suit of Frank J. Primrose, formerly a Philadelphia wool broker, against the Western Union Telegraph Company to recover damages for losses by reason of errors in the transmission of a telegram in June, 1887, is on trial. Mr. Primrose is now a resident of Chicago, but formerly did business at 153 North Front street, Philadelphia. The telegram, which was sent to William B. Toland, his agent at Ellis, Kan., was in cipher. It instructed Mr. Toland that Mr. Primrose himself had bought 500,000 pounds of wool, and that he, Toland, should not purchase any more at the time. The messages delivered to Toland instructed him to buy 500,000 pounds of wool, and said that Mr. Primrose had sold half of it. It is claimed that a loss of $21,000 followed, and that law suits ensued against Mr. Primrose for between $50,000 and $100,000, resulting in the financial ruin of Mr. Primrose.

.... Mr. Thomas J. Ramsey, manager of the Postal Telegraph Company at Milwaukee, has been elected an alderman in the Third Ward of that city. Now the poles will have to come down.

* * George B. Edwards, of Charleston, will erect an electric light and power plant and an electrical railroad, at Summerville, S. C.

* * At Nashville, Tenn., the South Nashville Street Railroad Co. and the Nashville and Edgefield street car lines contemplate using electricity as a motor power.

* * The Austin (Texas) street railroad has been bought by T. G. Hurley, of Fort Worth, and others, for $120,000, and the new company will spend $200,000 in extending it five miles and erecting a plant to operate the road by electricity.

* * At the telephone dinner at the Electric Club, it would have done all the absent telephonites good to have seen the way the names of those pioneer telephone workers, Messrs. Vail, Gilliland, Sargent, Storke and others were cheered when they were called out to make speeches in honor of the occasion.

* * The directors of the Biddeford & Saco (Maine) horse railroad are talking of introducing electricity as a motive power. A telegram was sent to Boston inviting representatives from both the Sprague and Thomson-Houson systems to come and look over the road and give estimates as to the cost of putting in an electric power plant.

* * The road which was designed to run down the North Denver Boulevard from Colfax avenue in Denver, Col., will be an electric road. Parties have about reached the price of construction of such a road as far down as Sheridan Heights, besides having ascertained the amount of subsidies which can be raised, and it is said they are decidedly satisfied with the outlook.

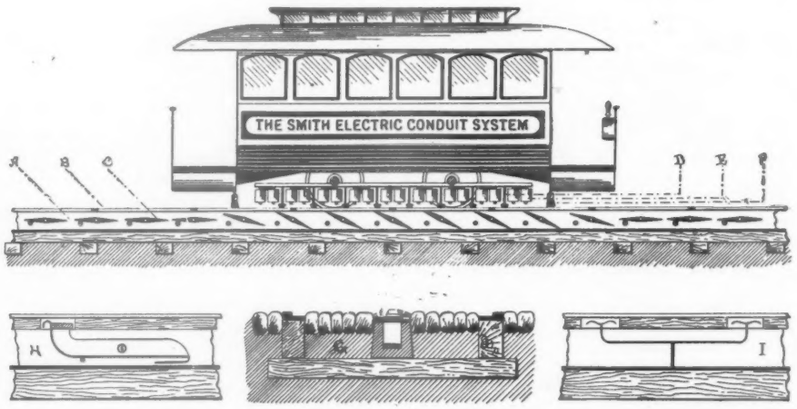
* * The approach of warm weather is marked by the large number of new electric railway contracts in all sections of the country, and the factories of the electric railway supply companies are now, we understand, literally taxed to their utmost. One of the most recent contracts among the large railway companys which have decided to adopt the electric railway system, is that of the Buffalo Street Railway Company, with the Sprague Electric Railway & Motor Co., of New York. The Buffalo company carries 11,000,000 passengers a year, and its endorsement of the electric railway system is regarded as a great triumph for electric power. Although the contract calls for a comparatively small number of cars at first, it is the intention, we understand, of the railway company to increase their electric equipment and extend the system throughout their entire line when the necessary franchises and consents can be secured.

* * There will be two electric street railroads in operation within the next two months in Cincinnati, Ohio. One will be out Main street toward the Zoo. The power-house at the top of the Mount Auburn inclined plane is already built. Many of the cross-lines are up, and the line will run from Fountain Square to the Zoo, the intention being to extend the road to Carthage later on, right of way over Carthage pike having been secured. It is the intention also to use an inclined plane truck like that at the Highland House and to run cars through without change. Another electric road will be constructed over Colerain avenue. This line will be in working order by June 1st, excavations for the power-house and machinery now being made, one of the large Harrison avenue stables having been remodeled for that purpose. Just as soon as the first half of the road is completed and its success demonstrated the work of extending the system over the entire route of the Liberty street line will be pushed forward.

The Smith Conduit System.

The Smith conduit, or electric carrier, is a hermetically sealed tube or box, preferably of wood, properly treated by any process calculated to resist moisture and rot, which is laid midway between the rails of any existing or new line of car track, and which can be put down at a small expense without seriously interfering with the constant use of such tracks by horse cars and the ordinary street traffic while such road is being altered from the old to the new system of propulsion. This conduit or tube contains the electric conductor or supply wire on its inside bottom surface, and its upper or exposed surface is covered with a series of non-magnetizable metallic plates, each about four feet in length, which are screwed down on to strips or sheets of insulating material, and each insulated from its neighbor, so that the surface of the conduit becomes a strip of metal, broken up into sections of not more than four feet each, from which the car, in passing along over its surface, may take off and use a current of electricity, provided they are, for the time being, directly connected with the source of supply at the bottom of the conduit.

This connection is made in the following manner (see cut): At distances of one or two feet apart, movable connecting pieces are attached to the electric conductor, and rest thereon by gravity, until such time as they are attracted from above. The car is provided with a row of magnets on its under surface, which pass along close to the metallic top of the conduit, and, in passing, attract by magnetic influence the connecting pieces before referred to, each of which is provided at one end with a small soft iron armature. It will thus be seen that as these "*connectors*" each rises up in its turn, through small holes in the top board of conduit, on touching the lower part of surface plate they form a direct electric connection between the cable and such top plates as the car and its magnets cover, so that such parts of the top plates, and *only such parts*, are always in electrical connection and form the medium from which the car in its passage is supplied with its current, and power for its electromotor.



The following letters in the illustration are explained:

A.—Longitudinal section of conduit.
B.—Insulated top plates.
C.—Connectors.
D.—Electric brushes.
E.—Electro-magnets under car.
F.—Sweeping brooms.
G.—Vertical section of conduit and track.
H.—Scale beam connector.
I.—Steel spring or band iron connector.

This system is being introduced by the Smith Electric Company, of 120 Broadway, New York.

* * At Asheville, N. C., Division Superintendent O. M Sadler, of the Northern Express Co., has signed a contract with the Asheville Electric Street Railway Company, whereby the latter company will, for the next twelve months, deliver all express matter coming to that city, at the Public Square, both going to and coming from the Western North Carolina Depot. This is a big thing for the e ectric railway people, and also a a great convenience for the express company.

In Honor of Monsieur W. D. Sargent.

A DINNER TO OUR TELEPHONE REPRESENTATIVE AT THE PARIS EXPOSITION.

A more enjoyable and successful social event has never occurred at the Electric Club than the dinner given Thursday evening, April 11th, by the telephonic co-workers and personal friends of Mr. W. D. Sargent, who is to represent the American Bell Telephone Company and the telephone interests of this country at the Paris Exposition. No man stands higher in the affections of his friends than W. D. Sargent, and his valuable and intelligent work in the telephone field has won him wide and deserved recognition. It was a most happy idea to have him represent the telephone interests of the United States at the great International Exposition at Paris this year, and a number of his New York friends appreciating this planned to give a dinner in his honor, to come off two days prior to his departure. The response on the part of Mr. Sargent's acquaintances was instantaneous and numerous, and he had the satisfaction of sitting down to dinner at a table where not one vacant chair was to be seen, and where every man was his personal friend and sincere well-wisher.

The telephone party for the evening took possession of the second floor of the Electric Club, using the library and manager's room as reception rooms, the table being located in the large dining room adjoining. The dinner began at 7.30 and was enjoyed until 10 o'clock, around a table in the shape of a cross, which was ornamented with several very large and beautiful bouquets, and draped with vines. A string band assisted digestion with the latest operas. Each of the gentlemen present received an elegant *menu*, engraved for the occasion by Mr. J. C. Clark, secretary and treasurer of Mr. Sargent's telephone company. A small brass telephone was attached, and the name of each guest appeared on each *menu*, the first page of which read as follows:

"Diner donné à S. E., W. D. Sargent, Commissioniare Téléphonique, par ses amis électricales, Jeudi, le 11ieme April, 1889. Electric Club, New York."

The *diner* was as follows:

Hello!

MENU.

HUITRES.
Platinum Points.
ROTAGE.
Infringer. Supreme-Courted.
POISSON.
Telephone Bloaters.
Roti.
Pigs in Clover.
HORS D'ŒUVRES.
Anti-Induction, in Twisted Pairs.
GIBIER.
Spring Jacks, Multiple Sauce.
PATISSERIE.
Sargent's Subway Pudding with Creosote.
CAFE.
New York and New Jersey, with Vitriol or Sal Ammoniac.

Good-Bye.

Mr. Charles F. Cutler, president of the New York & New Jersey Telephone Company, started the speech-making by introducing Mr. J. C. Clark as toast-master, who introduced a number of eloquent telephonists, each vieing with the other in saying good things about Mr. Sargent and his particular fitness for representing the telephone interests. An original song, full of advice to the Paris visitor, was sung by Mr. A. S. Hibbard, the audience joining in the chorus, and Mr. David Brooks told a story, from which the listeners have not yet recovered, and probably never will. The gentlemen present were the following-named:

W. D. Sargent, T. N. Vail, E. J. Hall, Jr., E. T. Gilliland, Alexander Cameron, L. Beckwith, John Jamieson, George Worthington, J. A. Seeley, C. H. Barney, J. C. Clark, J. C Reilly, H. G. McCully, John A. Barrett, G. A. Hamilton, F. A. Pickernell, W. C. Humstone, David Brooks, H. L. Storke, W. H. Fairbank, E. J. Hall, F. J. Hovey, H. B. Thayer, A. S. Hibbard, Chas. W. Price, F. W. Toppan, Charles Dutton, W. L. Candee, W. A. Vail, W. H. Eckert, Melville Egleston, Joseph P. Davis, C. F. Cutler, J. J. Carty, Amzi Dodd.

PERSONAL.

Mr. H. D. Stanley, of Bridgeport, was a welcome New York visitor this week, and is gradually recovering from a severe sick spell.

Mr. Morris W. Meade, superintendent of the Bureau of Electricity at Pittsburgh, was a New York visitor this week, a guest at the Electric Club.

Gen. Barney and H. B. Thayer showed a familiarity with the French language at the Sargent dinner that surprised their most intimate friends.

Uncle David Brooks' story at the Sargent dinner about the eloquent constitutional lawyer, whose forensic ability couldn't conceal the fact that his name was "Dockertee," was a popular feature, and he was persuaded to tell it twice.

Gen. O. E. Madden was, greatly to his regret, compelled to be absent from the dinner in honor of Mr. Sargent, on account of a very severe cold.

Mr. Thos. Cooper, of Toronto, has taken the position of special agent for Canada for the Ft. Wayne Jenney Electric Light Company. He visited the Electric Club last week, the guest of Mr. W. J. Morrison.

Mr. T. N. Vail sailed for Paris on the steamer "La Gascogne" Saturday last. Mr. W. D. Sargent sailed in the same ship. Both gentlemen were honored with the visit of a large number of friends at the pier to see them off.

Mr. L. A. Morrison, of Toronto, president of the Woodstock Electric Light and Power Company, and general agent of the London (Ont.) Machine Tool Company, visited New York and the Electric Club last week, the guest of his brother, Mr. W. J. Morrison.

Mr. James J. Wood, the well-known electric light inventor, is now a prominent member of the very active staff of the Ft. Wayne Jenney Electric Light Company, and is superintending the manufacture of his arc lighting apparatus at the new factory of the company in Brooklyn, N. Y.

* * An electric road is to be connected with the new Castle Shannon incline, at Pittsburgh.

Series Incandescent Lighting.

We recently published a description of the combination socket and series incandescent lamp which the Bernstein Electric Company make a specialty of. The socket-shell or cap is made of insulating material, and affords absolute protection against shocks; the socket combines the automatic cut-out and the "off and on" key.

The introduction of series incandescent lamps has developed a necessity for special devices for particular cases, and some of these are shown by the annexed cuts. As a loop of incandescent lamps in series presents a high resistance, an arc must form between the terminals of the switch controlling the loop whenever the switch is opened, and to prevent the maintenance of this arc the Bernstein Company have made a special switch, of which two types are shown in the cuts. An electro-magnet is combined with the switch in such a manner that the space between the switch terminals lies in the magnetic field, the coil of the magnet being in direct circuit. The arc formed between the terminals when the switch is opened is destroyed by the lines of force, and the action is said to be instantaneous. Of the two types shown, one is a simple "shunt" switch for controlling a few lamps, and the other is a "cut-off" switch for entirely disconnecting the loop from the main circuit, and is especially for use on outside of buildings.

The street fixtures represented by the cuts were designed by the company in consequence of calls from many of its customers who use its lamps for street lighting. The cuts show the fixture with the lamp in position, as in use, and also with the lamp removed and the socket exposed, as when the cut-out is to be renewed.

The company has now got its new factory into good running order, and is prepared to produce its lamps and fittings in large quantities; it reports steadily increasing demand, with indications that even its increased manufacturing facilities will soon be taxed to their utmost capacity.

Electric Wires in New York.

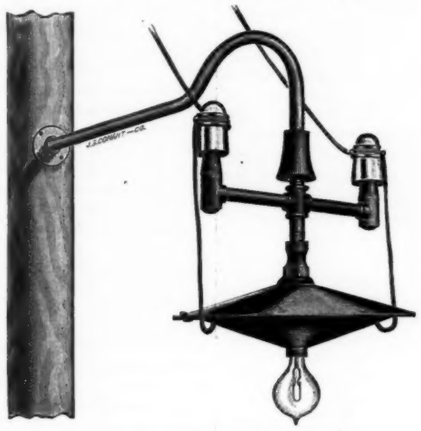
A number of the New York papers are from time to time finding fault with the Boston city government and the people of Boston because they permit electric wires of various kinds to remain above ground. Only a few days ago the New York *Tribune* had a gloomy editorial predicting the misfortunes which the people of this city might expect if they were so demented as to permit of above-ground wires to be used in running their street car system. Perhaps there are dangers in overhead wires, but, on the other hand, experience in New York is proving in a striking manner that there are also dangers in the so-called conduit system, and the same *Tribune*, in a half-playful, half-serious manner, warns the city authorities that it would be a blow to the prestige of New York if explosions in, and the blowing up of the manhole covers of the electric conduit of New York were to take place on the day of the great centennial celebration. As now constituted, it is pretty clear that the electric conduits in New York are dangerous contrivances. They permit of the accumulation of gases from the sewers and gas pipes, which readily penetrate through the earth, and having collected these, they provide by the electric current an admirable means of exploding them. No doubt, electric wires of all kinds will in time be placed underground, but the most earnest advocate of the change must concede that the conduit system used in New York is not free from serious imperfections.—*Boston Herald.*

—— The Danvers Gas Light Company is trying to prevent the town of Danvers from getting permission to furnish electricity for light and power to a private citizen, and the gas company has applied for such a right. The town is opposed to granting the petition.

—— At Buffalo, N. Y., the council committee on streets recommends that the telegraph, electric light and telephone poles be painted within 30 days. What color?

—— An effort is being made to organize an electric light company in Moorestown, N. J., and the project is receiving considerable encouragement. It is proposed to furnish incandescent lights for street purposes and private residences at about 1½ cents per lamp per night. Those prominently connected with the scheme are the Rev. J. H. Lamb, A. W. Moore, George Heaton, J. T. Sullivan, J. S. Rogers and Rufus Hill.

—— Waterhouse arc lighting installations as follows, by the Westinghouse Electric Company, are reported: Central stations: Huntington, W. Va., E. L. and Street Railway Company, 70 lights; Ashland, Oregon, 35 lights; Corning, Ia., Electric Company, 35 lights. Isolated plants: Sacramento, Cal., Southern Pac. R. R. Shops, 40 lights; Cosmopolis, W. T., Gray's Harbor Mill Company, 35 lights.

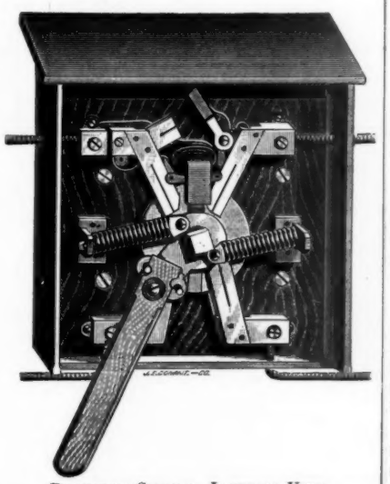


STREET FIXTURES—LAMP IN POSITION.

—— The Brooklyn Electric Light and Power Company, 343 Kent Ave., Mr Noah L. Cocheu, general manager, has written to the Board of Aldermen of Brooklyn asking for a franchise.

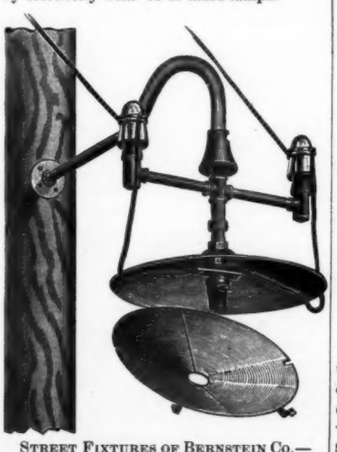
—— The Lawville Electric Light and Power Company, of Lawville, New York, are installing new electric light machinery of the Fort Wayne Jenney Electric Light Company.

—— Jacob F. Shiebley, of the Fostoria, Ohio, Electric Light Company, has brought suit for $10,000 against the Northwestern Ohio National Gas Company, at Toledo. The petition sets forth that the electrical machines were operated by natural gas, and that owing to imperfect connections an explosion occurred some time ago, damaging the works and building to the amount prayed for.



BERNSTEIN SWITCH—INTERIOR VIEW.

—— The taxpayers of West Troy, N. Y., has resolved to direct the board of trustees to cause the streets of that city to be lighted by electricity with 50 or more lamps.



STREET FIXTURES OF BERNSTEIN CO.—LAMP REMOVED.

—— The Edison Company has opened an agency in the Mitchell Building, Cincinnati. The agency is in charge of Geo. W. Coster, and Owen Ford is general manager, and personally takes entire charge of the construction. This is the sole agency in the State for the sale of Edison plants.

—— The electric light company of Stroudsburg, Pa., has increased its plant by a dynamo of the Slattery induction system. The American Illuminating and Power Company, of Cobourg, Ont., has also purchased a 650-light dynamo of the same system.

INTERIOR VIEW OF SWITCH.

—— At a meeting of the stockholders of the Ball Electric Light Company held at the offices of the company, 18 Cortlandt street, on April 9, 1889, the following trustees were elected: Sherman W. Knevals, Thomas S. Acheson, W. W. Flannagan, Charles E. Ball, Robert Dunlap, Sol Sayles, John C. Noyes, James H. Breslin, William L. Brown, George W. Cotterill, Wm. S. Hopkins. The officers of the company will be elected during the present week. The statement of the business of the company during the last year was entirely satisfactory to the stockholders present, and they report an unusual heavy spring business.

ELECTRIC LIGHT NEWS

—— An electric light plant is to be erected at Leesburg, Va.

—— The city council of Athens, Tenn., contemplate lighting the city with electricity.

—— Another Brush incandescent electric light plant has just been sold for use in Menominee, Mich.

—— A No. 7 Brush arc dynamo, with complement of lamps, has recently been furnished to the Union Stock Yards in Chicago.

—— The New York Atmospheric Conduit Electric Light and Power Company have filed articles of incorporation in Charleston, Va.

—— The Halifax Gas Light Company, Halifax, N. S., will start up two 650 light dynamos Slattery induction system this week.

—— Okonite wire is specified for all the wiring for electric bells and messenger calls in the Auditorium Building, Chicago. Over 200,000 feet will be required.

—— Woodstock (Ont.) Electric Light Company have decided to increase their electrical plant, and ordered of Mr. W. J. Morrison a 650 light Slattery dynamo.

—— The electric light company at Jamestown, N. Y., has decided to accept 20 cents a night from the city for each arc light supplied for street lighting.

—— The Westinghouse Electric Company is installing a large number of plants of the Waterhouse arc system for central stations and isolated plants.

—— The contract with the Narragansett Electric Lighting Co., at Providence, for 75 lights, which expired March 1, has been renewed at 50 cents per light per night; the contract for the balance of 175 lights expires June 15.

—— James Green, of St. Louis, has taken formal possession of the Sedalia Electric Light Works, and will immediately begin the erection of a fire-proof building. The plant will be increased to the extent of about $50,000.

—— The old iron electric light tower on the Astoria shore at Hell Gate is to be taken down. It was sold at auction about a year ago to New York parties. The tower was sold for $125 and it is said that the old iron is worth at least $3,000.

—— The Adams, N. Y., Electric Light and Power Company recently purchased a 50 light plant from H. H. Mills & Company, of Carthage, New York, who represent the Fort Wayne Jenney Electric Light Company in northern New York.

—— In the United States Circuit Court the 9th inst., Judge Coxe approved of the disclaimer filed by The Electrical Accumulator Company, and formulated the decree and injunction restraining the Julien Electric Company, their officers, agents and workmen, from further manufacture, use or sale, of secondary batteries of the Faure type, in which the active material is applied to the support in the form of a paint, paste or cement.

—— Plans for the new station of the Edison Electric Illuminating and Power Company, at Spokane Falls, W. T., are being prepared. The building will be 50x100 feet in size, and constructed of brick and stone. It will be provided with a water power of 1,000 horse capacity. Part of the extensions contemplated by this company comprise the building of incandescent mains in the Browne and Cannon additions, and on the North Side as far as the city limits. A new Thomson-Houston arc dynamo, with a capacity of 50 lamps, will be temporarily laced in the old station on the North Side.

MANUFACTURING NOTES.

Holmes, Booth & Haydens.—This well-known wire manufacturing company has taken the agency for the Washington Carbon Company.

The Visual Synchronism Company.—This company has removed to 34 Broadway, where handsome offices are being fitted up. Offices will also be opened in Boston next week.

Connecticut Motor Company.—This company is now placing its new motor recently illustrated in the ELECTRICAL REVIEW on the market, and in addition to this motor will soon have an arc light motor in readiness. Messrs. Fleming & Kimball, 17 Dey street, New York, are the selling agents of the company.

P. A. Dowd & Co.—Messrs. P. A. Dowd and Geo. W. La Rue, comprising the above company, with headquarters at No. 239 Broadway, New York, are two of the busiest electric motor men in the country. In addition to a large business in stationary motors, they have done a great deal of railway work, and find the field a most active and rapidly developing one.

C. & C. Motor Company.—The stationary motor business of this company is growing very rapidly. At the Pearl street station of the Edison Company in New York, some 75 horse power have been purchased recently, divided into different sizes, ranging from ½ horse power up to 15 horse power. Many other places in New York are demanding this motor, and the extensive works at 402 and 404 Greenwich street are greatly crowded.

Excelsior Electric Company.—This company is one of the busiest of the arc lighting companies, and the recent announcement of the completion of their arc light motor has resulted in crowding their large factory in Brooklyn with orders from all parts of the country. Mr. Hochhausen's work has always ranked among the very best in electric lighting circles, and his recent invention of this motor deserves the recognition it is receiving.

Pond Engineering Company.—Frank H. Pond, of the Pond Engineering Company, went to Kansas City last night, says the *Globe-Democrat*, to superintend the starting of the large Edison electric light station, for which his firm furnished the power machinery. The firm has also received a second order for an engine from the Kansas City Cable Railroad Company, and an order for an engine from the Little Rock *Gazette*, of Little Rock, Ark.

The Edison Machine Works.—The works of the Edison Machine Company at Schenectady, N. Y., at present employ 750 men, but additions which it is proposed to make to the present plant will greatly increase the number of employés. The company is negotiating for the purchase of eight acres of ground in the vicinity of the present works, and there will be erected several large buildings, so that the business may be greatly increased.

The Standard Underground Cable Company.—The United States Illuminating Company of this city has placed an order for 45,000 feet additional of the same cable as the 3,600 feet recently sold to that company by the Standard Company and used in the test required by the Mayor and the Board of Electrical Control of this city. This is an order of which Mr. George L. Wiley, manager of the New York house of the cable company, has reason to be proud, and is a very satisfactory recommendation as to the excellence of the cable manufactured by the Standard Company.

James W. Queen & Company.—This well known Philadelphia house has recently completed rebuilding, and now has a very handsome place and much better facilities for displaying the stock of electrical instruments. Professor William A. Anthony's instruments are in brisk demand and are preferred to other instruments of the same character. A new and improved photometer will shortly be on exhibition. This company has made arrangements for manufacturing a cheaper grade of ammeters and voltmeters in their factory; being simple in construction they are enabled to manufacture them at a reduced cost. Experimental work and all work of a special character pertaining to electrical matters will be under the personal supervision of Mr. Richard O. Heinrich, who is also prepared to work up inventions, etc., having just completed the equipment of his private laboratory.

Tucker Electrical Construction Company.—The Tucker Company is one of the busiest construction companies in the East, and has for some time been crowded for room. They have recently secured a fine suite of rooms on the second floor of the Paulding building, corner of Whitehall and Bridge streets, opposite the New York Produce Exchange. These offices are splendidly lighted and most conveniently arranged. The company expect to move in this week. Among the recent wiring contracts taken by the Tucker Company is the entire wiring of the new Plaza Hotel, 58th street and 5th avenue, for electric lights, bells and annunciator work. This hotel when finished will be one of the finest in the city, extending along 5th avenue the distance of the block of 58th and 59th streets. Some 5,000 incandescent lights will be used, the system of light not having been adopted as yet.

Not Ready for Electricity.

Connecticut is not yet ready to adopt electricity as a means of propelling murderers into the next world. It does not cost anything to wait and see what luck New York State has in shocking criminals to death.—*New Haven Palladium.*

Magnetic Phenomena of Iron-Nickel Alloys.

TO THE EDITOR OF ELECTRICAL REVIEW:

No theory attempting to explain the phenomena of magnetism can be regarded as conclusive which fails to account for the change which magnetic metals exhibit when heated.

It is well known that when iron is heated to a yellow red, or about 700° C., it ceases to be attracted by the magnet, and careful experiments show that the range of temperature in which the greater portion of this loss occurs is about 100°. Nickel has a similar critical range somewhat above the fusing point of lead, or about 350° C. The critical temperatures of the magnetic oxide of iron, or lodestone, and the protosulphide, are intermediate between those of iron and nickel.

It occurred to me that it would be interesting to examine the magnetic properties of alloys of iron and nickel, and I obtained the following interesting results:

An alloy of three parts of iron to one part of nickel had a critical range of temperature, as nearly as I could determine by the color, about the same as iron. When, however, the proportion of nickel in the alloy was increased to 50 per cent., the temperature at which the change occurred was a dull red heat, which is about midway between the critical ranges of the two metals.

This impresses me as a fact of profound interest, as it might be inferred that each metal would manifest its phenomena independently of its association with the other; yet, when the proportion of iron predominates, the nickel is subordinated to it; when the proportions are equal, a mean is the result; and if the nickel predominated, there is every reason to believe that it would prevail in determining the critical temperature, although I have not carried my investigations further than stated.

I present this interesting fact relating to these important metals in the hope that it may lead to a more definite knowledge of their molecular structure, and that it may also be utilized by some able investigator to give a deeper insight into the nature of alloys and the phenomena of magnetism.

WM. B. COOPER,
517 Locust street.

Philadelphia, Pa., April 13.

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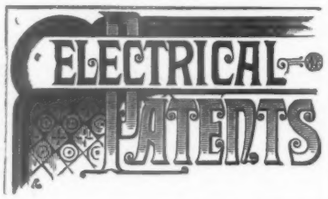

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 11, 1889.

400,430 Galvanic battery; Edward H. Crosby, Boston, Mass.

400,463 Lightning arrester; Myron D. Law, Philadelphia, Pa.

400,473 Device for supporting electric lamps; Alexander T. Moore, Jr., New Bedford, Mass., and Horace A. Fitch, Schenectady, N. Y.

400,476 Electric arc lamp; Samuel E. Nutting, Chicago, Ill., assignor to Nutting Electric Manufacturing Company, same place.

400,479 Electric gas lighter; John Y. Parke, Philadelphia, Pa.

400,486 Transfer system of electric distribution; Edwin W. Rice, Jr., Lynn, Mass.

400,492 Electric gas lighting device; David Rousseau, New York, N. Y.

400,515 Apparatus for regulating current or potential in secondary of transformers; Elihu Thomson, Lynn, Mass.

400,516 Method of regulating current or potential in secondary of transformers; Elihu Thomson, Lynn, Mass.

400,520 Arm support for telephones; Clarence R. Tuttle, Chicago, Ill.

400,523 Harmonic telegraphy; Francois Van Rysselberghe, Brussels, Belgium, assignor, by direct and mesne assignments, to himself and the Phono-Multiplex Telegraph Company, Baltimore County, Md.

400,525 Electrical railway signaling; William H. Waddell, Lexington, Va.

400,532 Telegraph wire carrier; Robert S. Donaldson, Wilkinsburg, Pa.

400,591 Telephone transmitter; William J. Morton, New York, N. Y.

400,629 Phonograph; Charles Batchelor, New York, N. Y.

400,646 Phonograph recorder and reproducer; Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Phonograph Company of New Jersey.

400,647 Phonograph; Thomas A. Edison, Llewellyn Park, N. J., assignor to the Edison Phonograph Company of New Jersey.

400,648 Phonogram blank; Thomas A. Edison, Llewellyn Park, N. J.

400,649 Method of making phonogram blanks; Thomas A. Edison, Llewellyn Park, N. J.

400,650 Method of making phonogram blanks; Thomas A. Edison, Llewellyn Park, N. J.

400,658 Electric lamp attachment for gas fixtures; Emil F. Gennert, Brooklyn, N. Y., assignor to the E. P. Gleason Manufacturing Company of New York.

400,661 Apparatus for determining electric or magnetic forces; Adolphus Gipperich, Richmond, Va.

400,662 Art of determining the value of electric, magnetic or electro-magnetic forces by weight; Adolphus Gipperich, Richmond, Va.

400,663 Apparatus for determining the value of electro-magnetic forces by weight; Adolphus Gipperich, Richmond, Va.

400,664 Process of reducing aluminium from its fluoride salts by electrolysis; Charles M. Hall, Oberlin, Ohio.

400,665 Manufacture of aluminium; Charles M. Hall, Oberlin, Ohio.

400,666 Process of electrolyzing crude salts of aluminium; Charles M. Hall, Oberlin, Ohio.

400,667 Process of electrolyzing fused salts of aluminium; Charles M. Hall, Oberlin, Ohio.

400,669 Safety device for electric circuits; William J. Hammer, Boston, Mass.

400,680 Prevention of sparking in electric motors and generators; Daniel Higham, Philadelphia, Pa., assignor to the Higham Electric Motor Company, same place.

400,692 Arc lamp; George M. Lane, Asbury Park, N. J.

400,734 Trolley for electrical railways; David A. Ainslie, Richmond, Va.

400,735 Trolley for electric railways; David A. Ainslie, Richmond, Va.

400,736 Method of regulating electric currents; Joseph W. Balet, New York, N. Y., assignor of one-half to Robert Dunlap and Luke F. Cozans, same place.

400,732 Electric switch; Sigmund Bergmann, New York, N. Y., assignor to Bergmann & Co. of New York.

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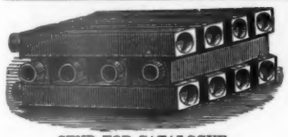

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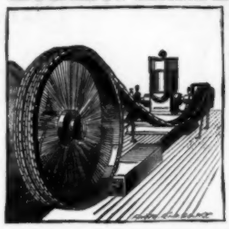

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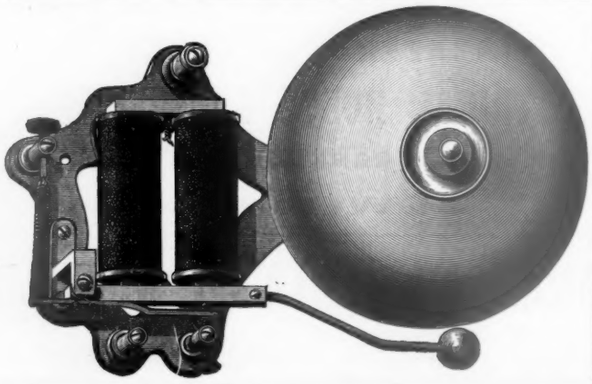

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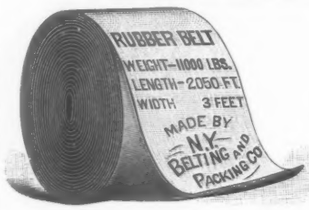

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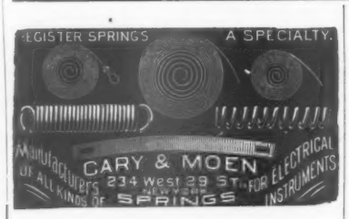
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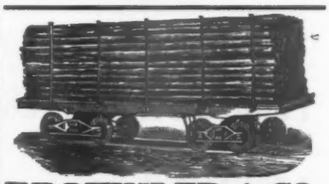

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The sample submitted for measurement was 2027 ft. in length.
Thickness of insulation was .281 c. m.
Diameter of wire .1632 c. m.

The wire was extremely flexible and was coiled and uncoiled several times before measurements were made.

The insulation consisted of several layers of India rubber, with an external cotton braiding.

The coil was immersed in water on Dec. 16 at 8.30 P. M., and tests were begun the following morning. Both the Direct and Loss of Charge methods were employed. The following are the results:

Capacity in Microfarads per Knot.	Insulation Resistance in Megohms per Knot.	Temperature Centigrade, Degrees.	DATE.
.453	11240	8.5	Dec. 17
.441	9558	13.3	Dec. 18
.456	10080	13.0	Dec. 19
.441	10183	11.0	Dec. 20
.450	9620	10.8	Dec. 21
.450	10000	12.0	Dec. 27

Direct deflection 7200 meghoms per knot at 12° C. on Dec. 27th. Conductivity was obtained by making a number of measurements of the diameter of the wire, and a determination of the resistance of the entire length of the sample at a definite temperature.

The conductivity was 98.5 per cent. that of pure copper as given by Matthiessen.

For the eleven days that the wire was in water the insulation resistance remained practically unchanged, and the slight variation which occurred can be accounted for by the difference in temperature, etc.

The insulation seems to be less affected by changes in temperature than that of other samples which we have tested at various times. Very respectfully,

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We beg to call your attention to the present state of our system of Traction on Fourth and Madison Avenues in this city.

The last car which we put into actual passenger service (Car No. 7), and which is the standard type of car that we have finally adopted, is making five round trips per day between Eighty-sixth Street and Madison Avenue and the Post Office, or 57½ miles daily. This is a car-day's work on that line.

During the past forty (40) days its receipts in cash have been $998.10, exclusive of 998 transfers, for which it gets no credit; this is at the rate per annum of - - $9,106.75
The average earnings of horse cars on the same Line are - - - - - - - 6,387.50
Difference in favor of the Julien System - - - - - - - - - - $2,719.25

Deducting from gross earnings $4 a day for driver and conductor, and $3.60 per day for motive power, wear and tear, and royalty, would leave per annum - - - $6,332.75
Further deducting 6 per cent. interest on $6.000 (cost of the car with battery, racks, stationary motors, etc.) - - - - - - - - 360.00
Leaves net earnings - - - - - - - - - - $5,972.75

These net earnings will more than pay the entire cost of the car and its equipment at the end of the first year.

During the time the car has been in operation neither the batteries nor the motors have required attention nor the expenditure of one dollar for repairs or renewals. Even the brushes have not been changed, nor do they show any wear.

Car No. 1 on Fourth Avenue line commenced service on September 3d ultimo, and on April 8th her batteries were examined for the first time. They had not in this period been lifted from the cells to be cleaned or inspected. They were found to be in as good condition as when they were put in service—not a single plate in the whole battery showing any wear, injury or depreciation.

At one time it was thought that the handling of the batteries in our system of traction would be a serious obstacle, but this Company has now a battery shifting device whereby, in the length of a car body and on either side of the pit over which the car stands in the station, sufficient batteries are stored and manipulated to do the work of one hundred and thirty-five horses. The racks which contain the batteries and the hoists, which are run by two small stationary motors, do not, in all, cover as many cubic feet as two sixteen-foot cars. By aid of this device the batteries are changed in less than three minutes. In actual time, less than five minutes are required to inspect the car thoroughly and change the battery.

An additional and important feature of this system is that a street railway need no longer have its own generating machinery, as must be the case with cables, over-head wires and conduit systems. In every town and city where there is a central lighting station, power for charging the batteries may be purchased for about two cents per horse power. So that the plant of our system will be reduced to the simple device of one battery-rack, as above described, for each set of fifteen cars and switch-boards for governing the distribution of the current. Can anything be more simple?

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Our new cars, thirty of which are now under construction by the Stephenson Company, will weigh but a fraction over six tons, or, in other words, but little more than the cars of the overhead system.

The following is a statement of mileage, passengers carried, etc.:

Record of Julien Storage Battery Cars on New York & Harlem Railroad City Lines, New York City, to March 31, 1889, inclusive.

Number of Car.	Miles Run.	Passengers Carried.
1	3,057⅓	27,076
2	1,276⅓	11,097
3	1,922⅓	16,040
7	1,875⅓	16,782

RECORD OF CAR No. 7.

This new car was put into regular service on February 23, 1889, and has since been run on a special schedule of 57⅓ miles per diem, exclusive of Sunday.

Date.	Passengers.	Transfers.	Mileage.	Trips.	Cash.	Remarks.
April 1	445	26	57⅓	5	$22.25	Rain
" 2	520	34	57⅓	5	26.00	Fair
" 3	537	26	57⅓	5	26.85	"
" 4	517	13	57⅓	5	25.85	"
" 5	570	8	57⅓	5	28.50	"
" 6	554	48	57⅓	5	27.70	"
" 7	Sunday					
" 8	536	26	57⅓	5	26.80	"
" 9	529	26	57⅓	5	26.45	"
" 10	561	13	57⅓	5	28.05	"
" 11	594	33	57⅓	5	29.70	"
" 12	533	15	57⅓	5	26.65	Rain

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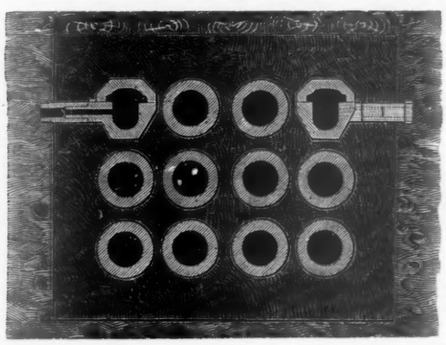

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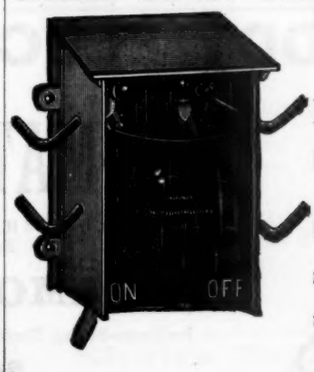

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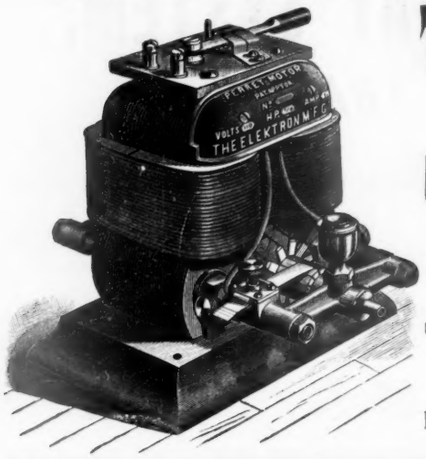

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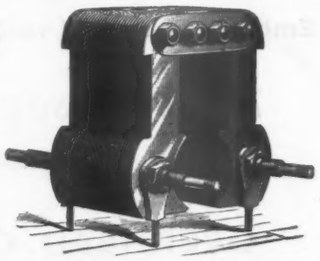

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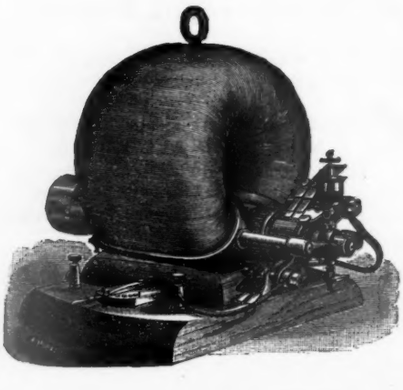

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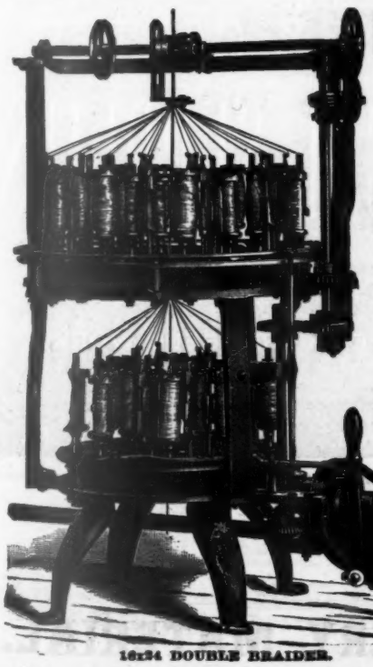

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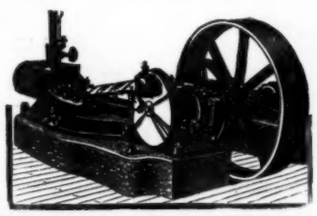

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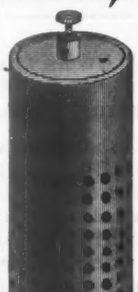

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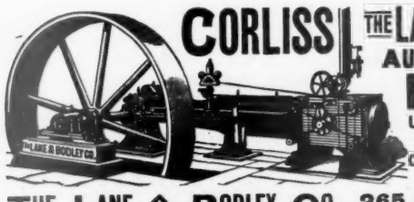

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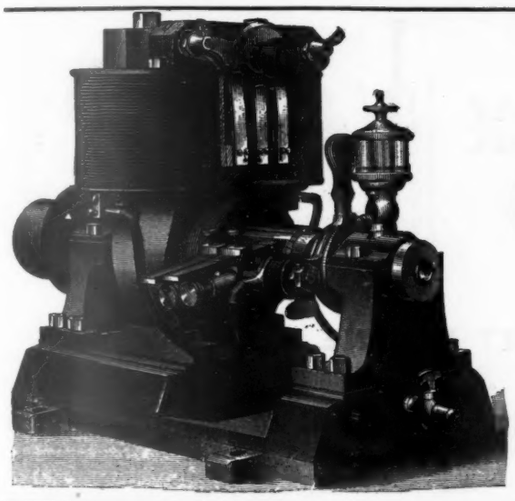

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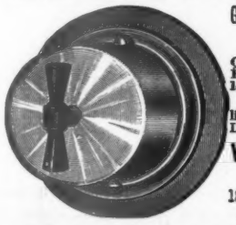

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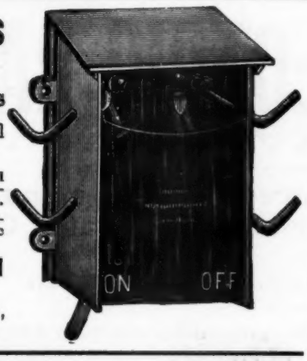

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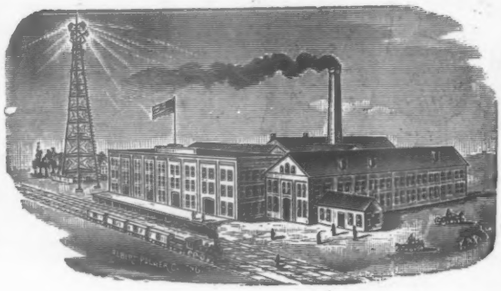

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